Do You See What I See? Pseudoenvironments, Ethnic Diversity, and Social Capital

Cara Wong* Jake Bowers Daniel Rubenson Mark Fredrickson
Ashlea Rundlett

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Abstract

How does place affect politics? Given two individuals who live in local contexts with virtually identical diversity, we show that the one who *thinks* she lives with more minorities tends, on average, also to see lower social capital among her neighbors. This finding separates the effect of objective social context from that of mental maps, revealing that context influences politics via perceptions. We also show great heterogeneity of perceptions among people living in virtually the same areas. Thus, increasing levels of ethnic heterogeneity need not produce lower trust (and, further down the causal chain, lower support for public goods). Instead, *mis*perceptions of diversity are driving these effects in part. The fact that neighbors do not see the same social reality suggests that public policies aiming to ameliorate intergroup conflict can focus on perception change in addition to urban planning.

Keywords: Context effects, power threat theory, contact theory, nonbipartite matching, respondent driven mapping.

*Associate Professor, Department of Political Science, University of Illinois @ Urbana-Champaign (carawong@illinois.edu). *Acknowledgements:* This research is funded by the Social Science and Humanities Research Council of Canada.

Hundreds of millions of people have left their countries of origin to live elsewhere, in both developed and developing states. Many of these migrants do not share the same race or ethnicity as their new neighbors, and this diversity — unprecedented in many places — has led both politicians and academics to ask what effect these demographic differences have on the well-being of receiving countries. In particular, what is the effect of Outsiders on the social capital of local communities? However, this attention to numbers presented by the U.N. or national censuses is focusing on only one possible mechanism by which environments can affect political attitudes and actions.

Behavior arises when a person interacts with an environment. The environment influences the person via two complementary yet different processes: (1) a process of exposure to a physical, objective milieu that requires no understanding on the part of the person to have its causal effect, *and* (2) a process requiring the creation of a mental image of the person's surroundings before an attitude or behavior can be produced. This idea that environmental or contextual effects operate by two paths is not new; for example, Lippmann (1922 [1991]) explains how people react as much, if not more, to "pseudoenvironments" than real environments. Although subjective and objective environments must combine to produce behavior, and although efforts to change norms and attitudes proliferate, the study of "context effects" (or "neighborhood effects" or "environmental effects") has largely focused on the objective because, as we will explain, measuring the pseudoenvironment has been very difficult, and disentangling the pseudoenvironment from the objective environment even more difficult. In this paper, we measure pseudoenvironments for roughly 7000 English-speaking Canadian survey respondents using hand-drawn maps and reports of perceptions of the social environments depicted. We then clarify the contribution of pseudoenvironments to attitudes about social capital and political engagement using nonbipartite matching to, in essence, remove the effect of objective context from comparisons based on pseudoenvironments. We neither take for granted that a process of mental image creation is taking place, nor do we believe exposure to a physical environment is all that matters. The context effects literature has built a strong theoretical edifice for understanding how environments might influence behavior and attitudes, and we take advantage of that theoretical work to develop expectations for how pseudoenvironments might relate to political judgments.

Studying pseudoenvironments in the context of attitudes and local geography raises two challenges. First is the challenge of measurement. How can we glimpse the mental images that people construct of the various groups in a given place? Second is the challenge of isolating the effects of pseudoenvironments from the effects of objective environments. We know that perceptions and understandings of locales lead people to choose to arrive at, stay in, and leave places. So, comparisons of people who perceive differently will not merely tell us about the effects of pseudoenvironments, but also about the effects of objective environments.

We confront both of these challenges using an online survey we conducted in English Canada. We tackle the first challenge by innovating in terms of measurement tools for capturing the mental images individuals create of their social and political surroundings: we ask people to draw the boundaries of their "local community" on a map (i.e., to measure the boundaries of a geographic pseudoenvironment) and then ask them to report on the characteristics of the people in that place. We build on the work on mental mapping pioneered by Lynch that has continued in geography and sociology and now political science (Lynch, 1973; Grannis, 1998; Tversky, 2000; Garling and Golledge, 2000; Matei, Ball-Rokeach and Qiu, 2001; Coulton et al., 2001; Svendsen, Campbell and Fisher, 2008; Svendsen and Campbell, 2008; Wong et al., 2012).

We confront the second challenge by matching people who live in nearly identical places into pairs, evaluating the resulting matched research design, and restricting our analysis to compare differences in perceptions between people within pairs. We show that perceptions can differ greatly — even for people living in virtually the same kinds of places — and that these differences in perceptions of diversity predict attitudes about the social capital of places. In addition, we find surprising confirmation that disentangling the effects of objective context from demographic characteristics — at least in a cross-sectional survey — is fraught with difficulties; one cannot "control for" education, for example, to determine the independent effect of objective contextual diversity if everyone who lives in the same type of context has similar levels of education.

Our research combining our online mapping tools and nonbipartite matching thus suggests that place turns into politics at least in part via the perceptions and pseudoenvironments long thought to be operational, but seldom directly studied or isolated from other influences.

In the next section, we discuss how diversity at many different geographic levels is related to social capital, as well as some of the potential mechanisms by which environments can affect political judgments. We then describe our data and measures, followed by an explanation of our research design and matching algorithm. After presenting our first set of results, based on a design that maximizes power, we discuss the results of four different replications, using slightly different designs. Finally, we discuss our overall results and raise a number of implications for public policy.

1 Diversity and Social Capital

People who live in diverse objective environments tend to display less social capital and social trust than people who live in homogeneous environments (Alesina and La Ferrara, 2000; Putnam, 2007; Stolle, Soroka and Johnston, 2008; Fieldhouse and Cutts, 2010; Uslaner, 2012; Dinesen and Sønderskov, 2012; Meer and Tolsma, 2014).[1] The greater the mix of groups in a geographic context, the more likely it is that a resident will be surrounded by outgroup members who seem less familiar or recognizable.[2] This lack of familiarity with those who are physically proximate — exacerbated perhaps by in-group biases (and even outgroup hostility) — then leads to less trust overall, inhibits one's ability to predict what someone else will do, and may therefore discourage cooperation (Brewer, 1999; Marschall and Stolle, 2004). Greater diversity (and the assumed dissimilarity that accompanies it) leads to people "hunkering down," avoiding social and political interactions with both their outgroup and ingroup (Putnam, 2007). Residents of diverse areas are less trusting of everyone, and they therefore volunteer less, donate to charity less, and are disinclined to cooperate with others to solve community problems.

There are other mechanisms that may also explain why diversity tends to be associated with lower levels of social capital in the aggregate. Research on support for social welfare programs discusses these alternatives, where outgroup members actually have different preferences, social norms, values, and forms of communication than ingroup members (Alesina and Ferrara, 1999;

[1] By "objective environment" we mean units of geography defined in some way other than by the individual (eg by the census or other government units) such as "cities", "blocks", "census areas" and so on.

[2] "Geographic context" refers to spatial areas, places, or "containers" such as governmental administrative units, schools, workplaces, religious institutions, or even informal places.

Alesina and La Ferrara, 2002; Costa and Kahn, 2003; Habyarimana et al., 2007). These differences — originating in group-level dissimilarities — diminish people's capacity for collective action (e.g., social capital) and thus these groups show less support for redistributive policies that would benefit everyone.

Scholars have also shown that the presence of immigrants can lead to feelings of threat, much as previous research about racial threat has shown in the United States (Key, 1949; Blalock, 1967; Oliver and Mendelberg, 2000; Citrin and Sides, 2008; Newman, Hartman and Taber, 2012; Enos, 2014). Furthermore, changes in numbers of immigrants — even more than overall levels — may affect political judgments (Green, Strolovitch and Wong, 1998; Hopkins, 2010).

In addition, Wong et al. (2012) argue that pseudoenvironments can affect these different mechanisms. People may misperceive the contexts in which they live, imagining that they live among fewer or more outgroup members than what is reported in the Census (Nadeau, Niemi and Levine, 1993; Sigelman and Niemi, 2001; Wong, 2007). And, people may *believe* that they do not share preferences, norms, or values with their diverse neighbors (irrespective of evidence in support or to the contrary). Just as the various scholars mentioned above have argued that diversity can diminish norms of reciprocity, civic engagement, and cooperation, we add to the research by stressing how *perceptions* of both diversity and dissimilarity can diminish beliefs about social capital and civic engagement as well. Just as perceptions of others' tax compliance can affect one's propensity to pay taxes (Frey and Torgler, 2007), this type of conditional cooperation can lead to lower social capital on the part of native-born residents. If an individual thinks that *They* will not work to benefit the community, why should she contribute and let them free-ride? The veracity of this belief is, unfortunately, irrelevant if she believes it is true and acts as such.

Although this paper focuses on the empirical and methodological challenges required to make this case, we note that our findings might push both theory and policy in new directions. For example, as we explain below, we speculate that the mechanism by which diversity diminishes social capital, if not also lowers support for public goods provision, has more to do with networks of trust and less to do with explicit political competition. We also show great and consequential diversity in perceptions *within the same neighborhoods*. This suggests that policies that focus on perception change, say, in

response to the movement of immigrants or refugees, may be as powerful as efforts to physically engineer urban neighborhoods, let alone consider policies to encourage partition and segregation. For now, this paper aims to stimulate more work so that the community of social scientists can develop an empirical and theoretical consensus to inform policy debates.

2 Data and Measures

We use data from an online national panel survey in English Canada that was conducted in April-July 2012, Mapping Local Communities Canada (MLCC). The MLCC sampling frame came from Vote Compass, a non-partisan electoral education initiative sponsored by the Canadian Broadcasting Corporation that allowed respondents to answer about twenty policy questions and place themselves in a policy space relative to the major political parties (which had also completed the survey). Over 1 million Canadians visited the Vote Compass website surrounding the May 2011 federal election. We contacted all of the 80,000 or so respondents of the 2011 Vote Compass who agreed to be contacted for future studies, and about 10 percent agreed to take our survey; 7817 respondents completed the survey.[3] The convenience sample is not representative of Canada as a whole, since respondents will obviously be more likely to be interested in and informed about politics and feel comfortable using technology than the average Canadian. Furthermore, our online survey was only conducted in English (whereas Vote Compass was conducted in both English and French). However, while our respondents' perceptions of their environments are not meant to be generalizable to the nation, our measures of context are broadly applicable, as are the questions our measures raise about standard practices of using pre-existing bureaucratic units as measures of context. We were interested in getting a wide range of responses, which we succeeded in gathering with such a large sample.

While it shares many similarities with other major immigrant-receiving countries, Canada is one of the most urbanized such countries, with about 80 percent of its population living in metropolitan areas (Aizlewood and Pendakur, 2005). "Visible minorities," the Canadian Census term for non-white Canadians, have grown from less than 1 percent of the population in 1971 to about 16 percent in the 2006 Census; about 1 in 5 Canadians is foreign-born. The effect of this diversity is particularly

[3]The different AAPOR response rates range from 11 to 15 percent. Compared to the 2006 Census, our respondents are older, better educated, wealthier, and more likely to be men and white.

noticeable in Toronto, Montreal, and Vancouver. For example, a 2005 Statistics Canada study projected that by 2017, when racial minorities will make up about 1 in 5 Canadians, both Toronto and Vancouver will likely be majority-minority. Furthermore, Canada has an official policy of multiculturalism, whose promotion of a cultural mosaic is not without its controversy (Bouchard, 2008). Because we are asking questions about reactions to racial/ethnic context, we restrict our analyses in this paper to majority group members (i.e., non-visible minorities).

2.1 What does the Census See? Measures of Objective Context

For our objective context measures, we use data from the 2006 Canadian Census.[4] We created context variables for Census dissemination areas (DA), which are composed of one or more blocks and have 400 to 700 individuals; they are the smallest Census unit for which all information is disseminated.[5]

We created an index of the percentage of visible minorities for DAs following the Statistics Canada definition of "visible minority" (which includes "persons who are non-Caucasian in race or non-white in colour and who do not report being Aboriginal").[6] In 2006, 50% of Canada's roughly 55,000 dissemination areas had less than 6% visible minorities.[7]

[4]We had intended to use both 2011 and 2006 census data to look at contemporaneous and changes in diversity. However, in 2011, the long-form of the Census — which is where Canadians are asked about their ethnicity and race — became voluntary in the newly renamed National Household Survey (Thompson, 2010). The response rate dropped 25 percentage points. The Census summaries for small geographic units (such as dissemination areas) were made particularly imprecise and/or likely to be missing given this change in the Census (Sheikh, 2013).

[5]The MLCC contains 6370 DAs.

[6]Our measure of objective context used the Census reports of responses to the following two questions which were introduced with the following text "Mark more than one or specify, if applicable. This information is collected in accordance with the Employment Equity Act and its Regulations and Guidelines to support programs that promote equal opportunity for everyone to share in the social, cultural, and economic life of Canada." "(1) Is this person an Aboriginal person, that is, First Nations (North American Indian), Metis or Inuk (Inuit)? (2) Is this person: White, South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.), Chinese, Black, Filipino, Latin American, Arab, Southeast Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian, etc.), West Asian (e.g., Iranian, Afghan, etc.), Korean, Japanese, Other (specify)."

[7]As a point of comparison, in Canada overall, visible minorities made up 16 percent of the population.

2.2 What do people see? Maps in Our Heads — Boundaries of Local Communities

To create a measure of personally relevant places that operationalizes our conceptualization of context, we developed an online map-drawing tool within a standard online political science survey. So, in addition to answering traditional survey questions, the respondents were also asked to interact with a few maps. At the start of the survey, they were asked to provide their postal code and check a Google Map that was centered on that postal code to make sure that we had correctly located them. Then, after answering a few questions about how long they had lived in their current home, the location of any previous homes, and whether they were homeowners or renters, they proceeded to the next screen with a new map centered again on where they lived. At that point, they were asked to draw their "local community."[8] The map-drawing task was one of the first in the survey, so the respondents were not primed to think about particular issues by other survey questions. They could draw any shape they liked, and they could also draw multiple shapes (i.e., there was no requirement to draw compact and contiguous communities). Figure 1 shows an example of 50 such maps drawn by people living in the Greater Toronto Area (GTA) overlaid on each other and on a Google Map of the GTA.

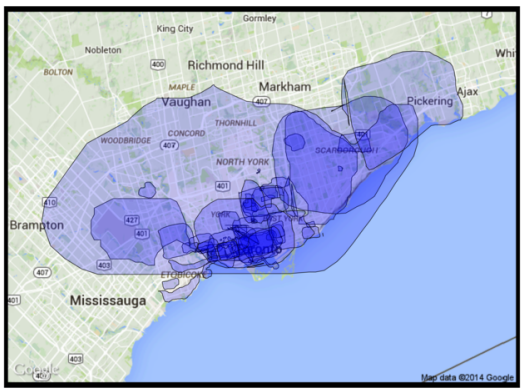

Figure 1: A random sample of 50 "local community" maps drawn by residents of Toronto in the MLCC

One advantage of asking respondents to draw their own communities is that they defined the boundaries of the context that was most salient and central to them; we do not need to assume that

[8]Because we are interested in the boundaries of a psychologically relevant place and the perceptions of the characteristics of this place, we did not define "local community" for respondents.

governmental administrative units (created by Statistics Canada or Elections Canada, for example) are the most relevant contexts for respondents, simply because objective data are collected at those levels. Furthermore, because these maps are individual-specific, we are able to sidestep the Modifiable Areal Unit Problem (MAUP) and the Uncertain Geographic Context Problem (UGCoP) (Wong, 2009; Kwan, 2012).[9]

2.3 Measures of Subjective Context: Content of Local Communities

After respondents drew their "local community" on the map, they were asked a battery of questions about their perceptions of the relative size of ethnic/racial groups captured in their drawing: "Just your best guess — what percentage of the population in your local community is ..." The list of groups included the following: Blacks, Canadian Aboriginals, Whites, Chinese, Latin Americans, South Asians (East Indian, Pakistani, Sri Lankan, etc.), and Other Asians (Korean, Japanese, Filipino, etc.). The percentage perceived visible minority in a context — following the official Canadian government's definition — was an index adding together responses for Blacks, Chinese, Latin Americans, South Asians, and other Asians.[10] So, our map drawing exercise captured both perceived

[9]The MAUP is a statistical problem of aggregation and scaling of which the problem of ecological inference is a subtype. Basically, one can show that nearly any relationship (correlation, coefficient from a linear or non-linear model, etc.) can be generated depending on how lower level units are combined to make higher level units and the relationships between explanatory variables and the units. The UGCoP arises in part from uncertainty about the actual space that has an impact. We sidestep these problems by focusing on maps drawn by respondents; the entire analysis of subjective maps is at the individual level with no aggregation problems, and the community drawn is the self-defined context that is most salient.

[10]Because people often overestimate the size of these groups, the index often exceeded 100 percent. The question format used an interactive slider, so any response between 0 and 100 was possible for each group. We created a few versions of this index to make sure that our results are robust to different specifications. Version 1 simply added up all responses for the VM groups. Version 2 runs from 0 to 1, where 0 represents 0 percent and 1 represents all responses that added up to 100 percent or more. Version 3 recalculated responses such that a respondents' answers for all groups totaled 100 percent; in other words, a respondent who said her community was 50 percent Latin American, 50 percent Black, and 50 percent White would have a VM score of 67 percent. We show Version 1 in the analyses that follow. Version 2 makes the display of information easier and down-weights outliers, but it throws away information distinguishing respondents whose estimates total 110 percent and 500 percent, for example. Version 3 helps address the issue of innumeracy — and the problem that many ordinary citizens do not realize that percentages should total 100 — but it makes the assumptions that the ethnic/racial groups listed are mutually exclusive and that they are the only ones that count.

boundaries and perceived contents of areas that individual survey respondents interpreted as "local communities."

Later in the survey, we showed respondents, at random with equal probability, a map with one of six geographic areas highlighted: the respondent's Census units (dissemination area (DA) or subdivision (CSD), corresponding very roughly to neighborhood and city, respectively); forward sortation area (FSA), a postal administrative unit; federal election district (FED); province or territory; or Canada as a whole. Respondents were told what the map represented, and then were asked the same battery of questions about the demographic make-up of this fixed geography. In other words, we have subjective perception measures for each of these contextual units from about 1/6 of our sample and for their "local community" from the entire sample. Thus, we have multiple measures of subjective context for each respondent.

Our respondents overestimate the percentages of visible minorities in their contexts: the median is 37 percent visible minorities for their "local communities" and 30 percent for DAs. This is about 4 or 5 times the percentage reported by the Census.[11]

2.4 Outcomes: Social Capital and Civic Engagement

The MLCC survey contained a number of questions about perceptions of local communities' social capital and community efficacy. The respondents were asked to agree or disagree (strongly or not) with the following three statements about the people in the local community they drew:

1. People around here are willing to help others in their community.
2. People in this community generally don't get along with each other.
3. People in this community do not share the same values.

[11] We estimated the objective content of the local community maps in two ways: first, we used the proportion visible minority of any Census DA that overlapping the local community map (which produces an overestimate of what the Census would have found within the local community map area); and second, we used only those DAs completely contained within the local community map (which produces an underestimate compared to what the Census would tell us if we had access to individual level data). In this paper, we use the overestimated data. The results reported here reflect the overestimation version. Regardless of how we approximate what the Census would see within the maps of the respondents, the white respondents consistently see more visible minorities than the Census would.

We created an additive index of the three items for a *Social Capital* Index.[12]

Respondents were also asked how likely or unlikely (very or not) the following scenarios would be, given the people in their self-defined local community:

1. If some children were painting graffiti on a local building or house, how likely is it that people in your community would do something about it?
2. Suppose that because of budget cuts the library closest to your home was going to be closed down by the city. How likely is it that community residents would organize to try to do something to keep the library open?

We created an additive *Community Efficacy* index from these 2 items.[13]

To assess the extent to which respondents felt safe and liked their neighborhood and bureaucratic units in which they live, we asked the following:

1. How worried are you about the safety in your neighbourhood?
2. On the whole, do you like or dislike your [DA, CSD, FSA, FED, Province, or Canada] as a place to live?
3. On the whole, do you like or dislike your neighbourhood as a place to live?

We added the latter two together to create a *Like Living Place* index.

Respondents were also asked their ideal housing preferences with a single question: If you could find housing that you liked, would you rather live with neighbors who share your racial and ethnic background, or who represent a mix of racial and ethnic backgrounds, or is it not important to you?

Respondents reported about their civic engagement and vote turnout with the following four questions:

1. During the past 12 months, have you worked with other people to deal with some issue facing your community or schools?
2. During the past twelve months, did you attend a meeting about an issue facing your community or schools?
3. Did you vote in the federal national election in May, 2011?

[12]We also replicated all analyses involving indices with the separate composite measures and found similar results.

[13]Sampson, Raudenbush and Earls (1997) use this concept of Community Efficacy in explaining disparate outcomes of otherwise similarly poor neighborhoods in Chicago.

4. Did you vote in the most recent provincial election?

These participation items were combined in two indices of *Community Participation* and *Vote*.

3 Analysis: How Does Context Affect Political Attitudes and Actions?

If perceptions of context matter for political attitudes and behaviors then a comparison of people who differ in their understandings of their neighborhoods should reveal differences in such outcomes. If two people differ in their perceptions of a place but also differ in the diversity of the place as measured by the Census, then we might wonder whether we have learned about pseudoenvironments or objective environments. However, if two people who do not differ in the diversity of their contexts do differ in perceptions and in outcomes, then we might say that the outcome difference is not due to objective context but rather to the complex processes by which the objective becomes subjective.

3.1 Design: Matching on Objective Context

What we want to test is whether people's lived experiences of their contexts have an effect, above and beyond objective conditions. Do their perceptions of how many outgroup members live around them affect their attitudes and actions, irrespective of who is, in fact, near them?

If we simply look at the effect of perceptions of context on a range of political attitudes and actions, any relationship could teach us more about the objective conditions, or the underlying characteristics or predispositions that lead people to choose to live where they do, than about people's beliefs about the demographic make-up of where they live. In other words, significant differences in perceptions could be due to differences in objective conditions, which in turn could be due to selection biases (arising from socioeconomic status, ethnocentrism, and perceptions of the place during the housing search process). Any comparison of perceptions across respondents is confounded by objective context unless we can remove from consideration such alternative explanations.

We use nonbipartite matching (or matching without groups) to determine whether two similar individuals who live in identically diverse contexts have very different outcomes, simply because one *perceives* more outgroup members than the other. We work to clarify our comparisons by matching all of the individuals in our survey into pairs that are maximally similar on the racial/ethnic composition (i.e., percent visible minority) of their Census DAs. Non-bipartite matching differs from common bipartite (or two-group matching) because we match all of our respondents to each

other using a continuous Census measure of the ethnic diversity of a local place. The algorithm that we use for this pair-matching is "optimal" in the sense that it minimizes the sum of the overall differences in percent visible minority within pairs across the whole dataset (Lu et al., 2011, 2001; Rosenbaum, 2009; Wong et al., 2012).

For the analyses, we match on respondents' DAs because the sizes of everyone's DAs are roughly the same.[14] We could compare individuals who live in similarly diverse DAs, or alternatively, we could restrict our comparisons to respondents who live in exactly the same DA. Because we lose about three-quarters of our sample if we only look within the same DAs, we first present our results making the comparison across comparably diverse DAs. However, we also implemented the alternative research design, since living in a diverse block in Toronto may be different from living in a diverse block in Vancouver. We discuss those results in a later section.

The other main factor we want to address is the population density of the DAs, since living in a rural area that is 10 percent visible minority can be a drastically different experience than living in a densely populated urban area that is 10 percent visible minority. Therefore, we encouraged our matching algorithm to avoid pairs that differed by more than 100,000 in municipal (i.e., Census Subdivision or CSD) population by penalizing such matches.[15]

Our matched designs substantially removed differences between people due to objective context: before any matching we would have compared whites living in areas with no visible minorities to whites living in places with nearly 100% visible minorities; in our preferred design 99 percent of the matches had a difference of less than 0.80 percentage points, and the maximum difference in percent visible minority was less than 2.3 percentage points; 50 percent of the matches were identical. The median difference in CSD population between the matches was 8070, and the maximum was

[14] In other work, we look at the objective context determined by the boundaries they drew of their local communities. This involves some approximation, since no community drawn corresponds exactly with the boundaries of a government bureaucratic unit. Because community sizes also can vary a great deal — ranging from part of a street to multiple continents — matching on the diversity of respondents' DAs ensures that the areas surrounding their homes are comparably similar in their demographic composition, population size, and land area.

[15] See the appendix for more information about the matches. All of the open-source code required to reproduce this paper will be provided in a Github or bitbucket repository so that others may learn how to produce such matched designs.

100,000; 30 percent of the matches were identical on municipal population size.

An unexpected benefit of matching on proportion objective visible minority is that our pairs were also similar on other background characteristics. We assessed balance on age, income, years living in the same residence, area of hand-drawn community (in square km), sex, and education (in 8 categories). We also included in this balance assessment variables indicating missing values on these covariates. For example, we could show that before matching percent visible minority in the DA was strongly related to the number of years a respondent reported living in that location (z-score of -8.1 with $p = 4.0 \times 10^6$) and also to the willingness of a respondent to answer this question ($z = 4.7$ and $p = 2.3 \times 10^6$), but after matching these relationships weakened considerably ($z = .33, p = .74$ and $z = .24, p = .81$ for tenure and missing tenure respectively).[16] Across the different covariates, the z-statistics ranged from 0.10 to 56 before matching but 0.05 to 1.89 after matching. Figure 2 shows this information across all of the covariates.

[16]The balance assessment method of (Hansen and Bowers, 2008) generalizes to continuous explanatory variables directly although the d statistics that summarize differences in means are no longer easy to interpret. Instead, we present z scores and p-values to describe the magnitude and direction of the differences between respondents on a given covariate with and without conditioning on the matched design. Our procedure basically regresses the covariate on the explanatory variable (with adjustments for the stratification induced by the matching) and then calculates a z-score (instead of a t-score) because the probability distribution characterizing our null hypothesis holds the design fixed and simply swaps which member of a pair has the higher value (i.e., it uses the analogy of a repeated experiment to generate the distribution of the z-statistic under the null hypothesis of no effects).

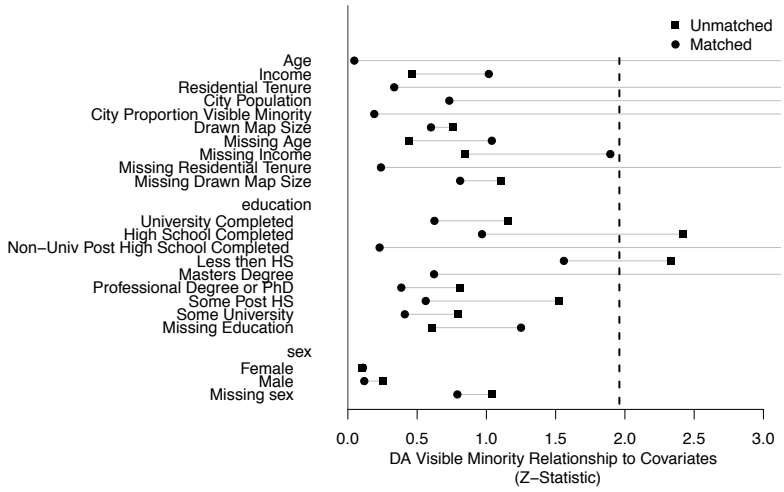

Figure 2: Relationships between % visible minority in the DA background covariates before versus after non-bipartite matching on proportion visible minority in the DA with penalties for matches differing more than 100,000 in municipal population using the z-scores from the Hansen and Bowers (2008) approach to assessing matched designs. After matching the z-scores decreased: conditional on matched pairs, the relationships between covariates and % visible minority in the DA decreased. The dashed line is at $z = 1.96$. Circles represent the z-scores for the matched pair design. Squares show the z-scores for the raw data before matching

Can we say that our matched design is "balanced" or that we are making comparisons within pairs that do not overly reflect the influences of background covariates? One interpretation of this question is to ask whether we would be surprised to see such a configuration of differences in a randomized experiment with the same design characteristics as we see here (same sample size, same individuals paired with each other, same covariates, etc.). An omnibus test of the hypothesis that the relationships between percent visible minority in the DA and all of the covariate terms shown in Figure 2 were all zero, reported $p = .85$ for this hypothesis conditional on the matched sets but $p = 0$ before matching (Hansen and Bowers, 2008). This hypothesis test compares the relationships arising from our observational paired design to the equivalent set of relationships that we would see in a randomized paired design. We would not be surprised to see such a configuration of relationships in a randomized version of our design.[17]

[17]Because these p-values do not take into account any clustering of respondents in DAs and CSDs, they are overly liberal (i.e., too small). So, we are somewhat overstating the size of the relationships here.

We were prepared to add additional penalties and/or use propensity scores to improve our comparisons. However, the omnibus balance test tells us that, without making any other adjustments, the person within the pair who has a higher age, more income, more education, different gender, a longer length of time lived in their current home, more ethnic diversity of their CSD, a larger population size of their CSD, and larger community area is no more or less likely to be living in a dissemination area with more or less visible minorities according to the Canadian Census than the other member of the pair. This occurs in part because the matching creates pairs that are similar in terms of those covariates (people with the same education are likely to live in the same place).[18] This also occurs because our matched pairs have almost no variation in proportion visible minority within the pairs themselves. In other words, simply by matching individuals on the ethnic diversity of their DAs and taking into account whether they are living in more urban or rural areas, we can remove the relationship between the proportion visible minority in the DA and background characteristics of people that would otherwise be very strong. In fact, the matched design confirms that there is a great deal of self-selection when it comes to where people choose to live; they live near others like them, whether that is because they share similar preferences (e.g., housing proximate to schools) or because they simply have the resources to maximize benefits that everyone would prefer (e.g., safe neighborhoods). Before matching, if we knew the age, education, and residential tenure of respondents, we would have been able to predict the proportion visible minority of the DAs in which they lived. Within pairs matched on proportion visible minority in the DA, none of these variables have explanatory power to predict the proportion visible minority in the DA for a person.[19]

Having created a design to make pairs homogeneous on objective ethnic context and removed, as a side-effect, the relationship between SES and objective context conditional on pair, we turn next to our variable of interest: people's perceptions of the ethnic diversity of their local communities.[20]

[18]This similarity fits with what Sampson and his colleagues found: poverty and disorder tend to be highly correlated with racial diversity (Sampson and Groves 1989; Sampson et al. 1997).

[19]This does not mean that respondents within matches are identical across these covariates; for example, the median age difference within pair is 13 years, and the median difference in income is 3 (on a scale ranging from 0 to 11). However, 70 percent of the matches are identical when it comes to education (measured using an 8-category variable), and the median difference in VM at the CSD level is less than 1 percent.

[20]We focus first on respondents' self-defined communities because these are the most salient

It is quite possible that after matching individuals on the objective characteristics of where they live — which then removes the relationship between objective context and life circumstances— there may be little or no difference in their perceptions of their surroundings and thus no information available to disentangle the effects of pseudoenvironments from the effects of objective environments on their attitudes and reported behaviors. Figure 3 plots the respondents by their objective and subjective context, connecting each matched pair with a line segment. Despite removing relationships between objective context and education, income, and gender — variables that scholars have shown are strongly related to political knowledge — respondents in matched sets still differ a great deal when it comes to the way that they represent their lived experiences via perceptions of their social context.[21]

Their views of who lives around them — particularly the proportion of ethnic outgroup members — vary. Perceptions of context are not the same as experiences of objective context and thus may have explanatory power, independent of objective context as reported by the Census.[22] The fact that the lines are all relatively flat means that the matches are very similar in the diversity of their DAs (another sign that our matched design is helping us compare like with like); the lengths of the lines tell us that perceptions of these matches differ.

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and personally-relevant geographic contexts. Nevertheless, because we are aware that we may be comparing communities of drastically different sizes, we also use respondents' perceptions of their DAs as an alternative measure of subjective context. We discuss those results in a section that follows.

[21]To reiterate, the respondents within matches are *not* identical on their individual-level characteristics; for example, across matches, the respondents who perceive more VM in their local communities are more likely to be female and slightly poorer. This is not surprising, since gender and income also predict political knowledge. However, respondents within pairs are largely indistinguishable when it comes to age, length of residence, size of the local community area drawn, and 7 of 8 education levels (all except for having a master's degree).

[22]We are not focusing on accuracy of the perceptions here. So, the respondent who perceives greater diversity could be more or less accurate than her match. Similarly, both respondents could be quite inaccurate.

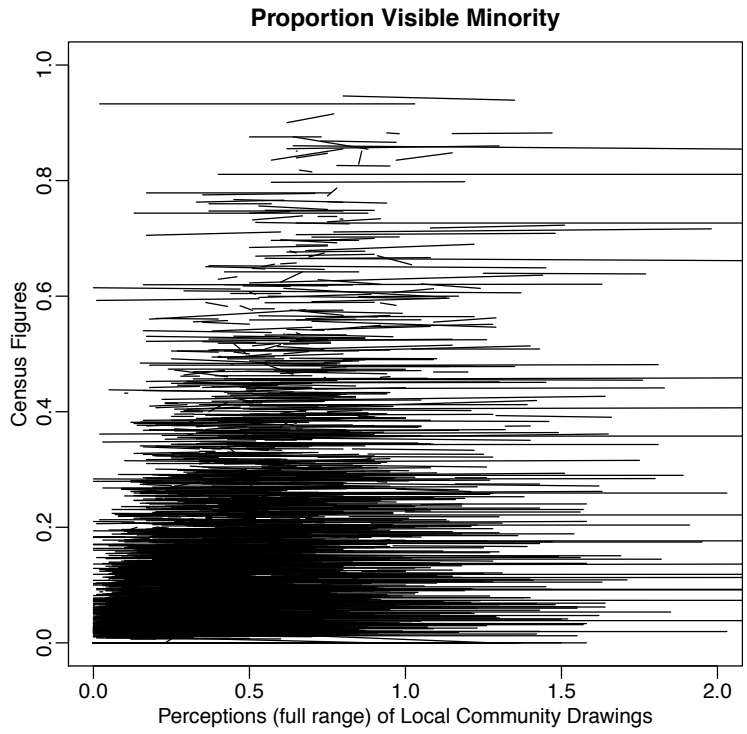


Figure 3: The Objective and Subjective Context of the Matches. The y-axis is the percentage of visible minorities in the Census DAs. The x-axis is the perception of the percentage of visible minorities in respondents' "local communities," truncated at 2. (Only 18 respondents gave responses that added up to more than 200 percent.)

3.2 Subjective Context, Social Capital, and Civic Engagement

Past research on ethnic context and social capital articulates a variety of reasons that lead us to expect that people who perceive greater diversity than their paired referents will report comparably diminished civic engagement and trust even though both people are exposed to basically the same objective context. The person who perceives more might feel as though the out-group members pose some kind of threat, for example. We assessed these effects using multilevel models for respondents $i = 1, \ldots, n$ with crossed random effects for both matched pairs $s = 1, \ldots, S$ and dissemination areas $d = 1, \ldots, D$ and a variety of outcomes measured in the MLCC survey (y_{isd}):

$$y_{isd} = (\alpha_s + \alpha_d) + \beta_1 \text{perceptions}_{isd} + \beta_2 \overline{\text{perceptions}}_s +$$
$$\beta_3 \text{objective}_{sd} + \beta_4 \overline{\text{objective}}_s + u_{isd}$$
$$\alpha_s = \gamma_{s,0} + e_s$$
$$\alpha_d = \gamma_{d,0} + e_d$$

This specification adjusts the estimates of the effects of perceptions for (1) the effects of pairing (α_s) (Smith, 1997) and helps standard errors take into account the fact that the sample is somewhat clustered by DA (α_d).[23] To avoid problems arising from correlations between community perceptions and unobserved DA-level effects (what some call bias from correlations between error and random effects), we include in the models the average perceptions for each pair ($\overline{\text{perceptions}}_s$) (Bafumi and Gelman, 2006); because not every match was exactly identical for percent visible minority, we add the objective numbers of visible minorities in the respondents' DAs to the model, along with the average visible minority for the matched pairs ($\overline{\text{objective}}_s$) again to remove correlation between u_{isd} and α_s, which could bias our estimates of β_1.[24]

We begin by looking at the effect of people's pseudoenvironments on their attitudes about social cohesion in their local communities. Figure 4 shows the effect of perceiving more minorities on attitudes relating to the social capital and community efficacy of respondents' local communities, as well as on how much they like and feel safe in their communities.

[23] Roughly 4900/7000 respondents are the only survey respondents in their DA, but about 940 share a DA with 1 or 2 other respondents, and 40 have 4,5,6 or even 10 other survey respondents in the same DA.

[24] We presume that e_s, e_d and u_{isd} are all Normal and independent of each other. The idea to combine regression adjustment with matching adjustment is inspired by Rubin and Thomas (2000).

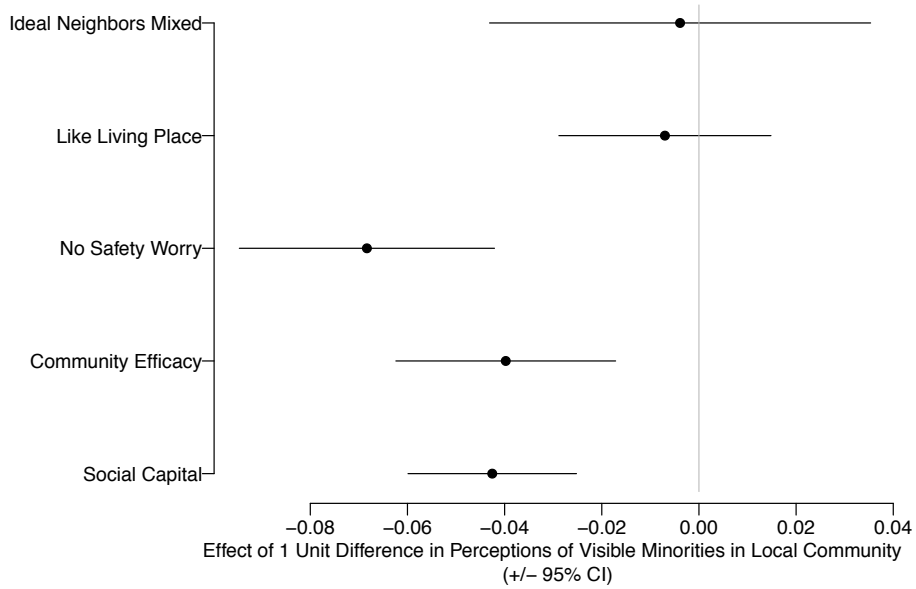


Figure 4: The effect of perceptions of visible minorities in environment on social capital, community efficacy, and attitudes about community conditional on matched pairs. Points show the estimated effect of perceptions of visible minorities in the hand-drawn "local community" on outcomes (listed on the y-axis) conditional on matched pair. The segments show 95% profile-likelihood confidence intervals following Bates (2010); Bates et al. (2014).

For two respondents who live in almost identical contexts, the one who perceives more minorities in her local community is more likely to think people who live in that community do not share the same values, do not get along, and would not help each other. The one whose pseudoenvironment is more diverse would also be more likely to think people in her community would not intervene to stop children painting graffiti or act to stop the closing of a library in that community. These results may help explain why diversity diminishes support for social goods provision: the sense of reciprocity and shared preferences is weaker when ingroup members believe they live among more outgroup members.[25]

The social capital and community efficacy indices capture attitudes about what respondents think *other* people in their community would do. However, perceptions of their local community

[25]Given research by Stolle and Harell, there is reason to believe that our results may be particularly strong because our sample is older. They argue that among younger cohorts, the relationship between diversity and greater antagonism is erased, if not reversed.

also affect the attitudes of the respondents themselves. If two individuals live in equally diverse areas, the one who perceives her community as more diverse will be more likely to worry about the safety in her neighborhood, she may be a little less likely to like where she lives, and her ideal neighbors would share her racial and ethnic background (although neither of these last two effects can be distinguished from zero at $\alpha = .05$).

The effect of perceptions is much less clear for respondents' behaviors, relative to their attitudes. Figure 5 shows that respondents who see more diversity in their communities are not likely to be more or less politically active in community affairs. Subjective community context also does not seem to affect political participation on a larger scale: respondents who picture in their minds greater diversity in their local community are no more or less likely to vote in provincial and national elections than those who see less diversity (the effect size is close to zero). The coefficients are negative and are in line with arguments about "hunkering down" in the face of diversity; however, since neither relationship is strong or precisely estimated, we do not want to make too much of these differences.

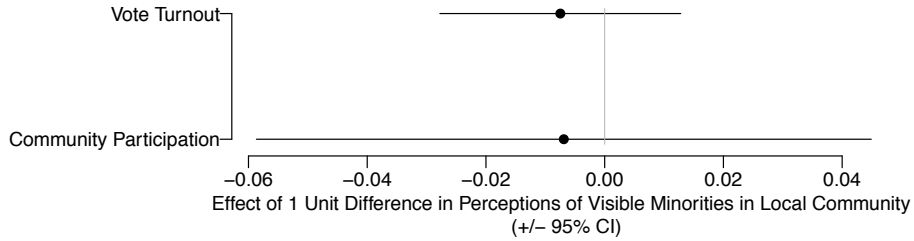


Figure 5: The Effect of Perceptions of Context on Community Participation and Vote Turnout. Points show the estimated effect of perceptions of visible minorities in the hand-drawn "local community" on outcomes (listed on the y-axis) conditional on matched pair. The segments show 95% profile-likelihood confidence intervals following Bates (2010); Bates et al. (2014).

So, while perceptions of one's community's diversity affect attitudes about its social capital, efficacy, and safety, they have limited effects on political behavior.

3.3 Alternative Design 1: Perceiving More Diversity in One's Dissemination Area

Thus far, we have used individuals' reported perceptions of their own hand-drawn communities because (1) it is the local context most salient and central to the respondents, and (2) we have data on

these perceptions for the entire sample. However, we are still comparing people who drew different maps and reported different perceptions of different objects, even if they lived in nearly identical places in terms of ethnic diversity. As mentioned earlier, as part of our study we randomly assigned each respondent to view the polygon for one of six official Canadian geographic units overlaid on a Google Map containing their home and also to report their perceptions of this unit. Thus, for 1/6 of our sample, we have reports of perceptions of their own Census DAs.

Using only those respondents who reported on the perceptions of their own DA, we match again on the percent visible minority as measured by the Census for the respondents' DAs, and penalize matches that differ by more than 100,000 people in municipal population. The matches are again very well balanced: 20 percent of the matches are identical on their DA level diversity; the median difference in percentage visible minority between matches is 0.01 percent; 97 percent of matches have a difference of less than 0.94 percent, and the maximum is 1.3 percent. When it comes to population size, 30 percent of the matches are identical, the median difference is 14,100, and the maximum difference is 98,200. The balance tests, using the same covariates as for the earlier matches, show a marked improvement with matching and even more with the penalty. Before any matching, the omnibus p-value is less than 0.000; matching on the percentage of visible minorities in DAs with penalties for CSD population size results in $p = .970$.

Cross-classified multilevel models using these new matches in which people see a fixed geographic unit show similar results as the analyses run for the previous matches using all the respondents. (See Appendix for analyses.) We see the same pattern of results: those who perceive a more diverse dissemination area within their pair tend also to be those reporting diminished perceptions of social capital and community efficacy, more worries about safety, more negative affect toward where they live, and more support for the idea that ideal neighborhoods are homogeneous. While the coefficients for the civic engagement outcomes are negative, their effects are still indistinguishable from zero.

3.4 Alternative Designs 2 and 3: Matching on the Exact Same DA, Perceiving One's Community or One's DA

It is possible that matching someone from a DA in Vancouver and a person living in an equally diverse DA in Toronto is not a good comparison; the cities have distinctive histories and demographic

compositions, among other characteristics. Therefore, we replicated our analyses, matching only individuals who lived in exactly the same DA; we looked at the effects of perceptions of both their self-drawn communities and of their DAs. Of course, since the majority of our sample lived in DAs for which they were the only respondent, and only 1/6 of our sample were asked to describe their DAs, the sample sizes are even smaller for these replications.

Even when we match respondents who live in the same DA but perceive different levels of diversity in their own hand-drawn local communities, our overall story is unchanged. Among individuals who live in exactly the same dissemination area, the one who sees a more diverse community perceives lower social capital and community efficacy, worries more about her safety, likes where she lives less, and think her ideal neighbors would be ethnically homogeneous. Similarly, for two individuals who live in the same DA but who see more or less diversity, there is no discernible difference in their community participation or vote history. (See Appendix for analyses.)

There are only 13 pairs of individuals who lived in the same DA *and* were asked to describe that DA, but even though there is a great deal of noise, the coefficients tend to be in the same direction as in the previous analyses. (See Appendix for analyses.)

3.5 Alternative Design 4: Diversity Index for Both Matching and Perceptions

Living in a community where a single outgroup forms a majority (e.g., a largely biracial city like Atlanta, Georgia or Richmond, British Columbia) could be quite different from living in a community where no single group is the numerical majority, but where the numbers of multiple different visible minorities add up to more than 50 percent (e.g., a city like New York or Vancouver). By focusing on the percentage of visible minorities aggregated — for measures of both objective and subjective context — we may be comparing apples and oranges; this is especially true if attitudes and behavior are driven by perceptions that one's ingroup is outnumbered by a unified outgroup. Therefore, we rerun our analyses, this time using a diversity index for both the matching algorithm and for the perception measure.[26] In other words, we match individuals whose DAs are similar in fractionalization and compare the effects of perceiving greater fractionalization (using respondents' perceptions of the size of each group instead of Census numbers in the formula). Scholars have

[26]We use the Herfindahl index, also known as the Herfindahl-Hirschman or Simpson index.

argued that diversity or fractionalization indices can often hide a great deal of heterogeneity across cases (Fearon, 2003; Posner, 2004), so in addition to the population size penalty used in previous analyses, we penalize matches that differ by more than 5 percentage points in overall percentage of visible minorities in the DA.[27]

With the penalties, the matches differed by less than 0.02 on the fractionalization score (which ranges from 0 to 1). An omnibus test of the hypothesis that the mean differences across all of the covariates used before were all zero, reported $p = .91$ for this hypothesis conditional on the matched sets, but $p = 0$ before matching (Hansen and Bowers, 2008).

What is the effect of perceiving greater fractionalization on attitudes about social capital? The results are surprisingly similar to those we found earlier: the individual within each pair who sees greater heterogeneity reports less social capital and community efficacy. She is also less likely to feel safe or like where she lives, and is more likely to describe her ideal neighborhood as homogeneous. Greater perceived fractionalization also seems to have no detectible impact on community participation. The respondent in each matched pair who sees more heterogeneity is less likely to turnout to vote (and in this analysis, the coefficient is distinguishable from zero).

4 Discussion and Conclusion

There are two kinds of context effects: one kind (the effect of objective context) does not depend on an individual perceiving and/or understanding the character of the context (for example, imagine the effect of registration laws or particulate pollution); another kind, which we call pseudoenvironments following Lippmann (1922 [1991]), does not have effects on attitudes and behaviors unless it is perceived and judged. We add to the broad literature on context effects by (1) pointing out that one kind of "context effect" is an effect that is individual-specific (i.e., it is the effect of a pseudoenvironment) and by proposing one possible measure for this kind of environment, (2) showing how people living in nearly identical objective environments have quite different pseudoenvironments, and (3) that these pseudoenvironments predict attitudes in the direction expected by past literature

[27] Without the addition of this penalty, the minimum difference in percentage of VM in a DA was over 40, even when we allowed the algorithm to drop 500 observations.

even when objective environment is held nearly exactly constant.[28]

The fact that perceptions of greater diversity lead to lower expectations for social capital and community efficacy, while not having a clear negative effect on civic engagement raises questions for future studies. The MLCC survey questions about respondents' civic and political participation may be too general, relative to the specificity of the efficacy questions, for example, although previous research has focused on the same questions of participation and shown similar differences between attitudes and actions. It is possible that there is simply too much noise in the participation items to discern the effects clearly; the coefficients do tend to be negative. Finally, it is also possible that for two white individuals who live in similarly diverse contexts, the person who sees greater diversity has different beliefs about her community, but seeing more visible minorities does not affect her voting or community participation behavior.

In any event, our findings regarding the attitudinal outcomes are enlightening: respondents who see more diversity around them expect that others in their community will be less likely to share the same values, help each other, or mobilize to benefit the community. The literature on "conditional cooperation" suggests that different mechanisms — including norms and reciprocity — may explain the existence of greater civic-minded behavior than would be expected from theories of self-interest (Frey and Meier, 2004; Frey and Torgler, 2007). Answers to our survey questions suggest both mechanisms are at work, but that *perceptions* play a key role. Outgroups may indeed have different norms about altruism, but even if they do not, *beliefs* that outgroups differ in norms may still affect political judgments. In other words, people who perceive more outgroup members in their communities may also be more likely to perceive that these outgroup members do not share their same values and practices that promote prosocial behavior.

Why should we care particularly about perceptions and pseudoenvironments? Public policy can, in principle, change pseudoenvironments more easily than objective contexts. Housing cannot be assigned to individuals in liberal democracies (except for among special populations, like refugees or people dependent on certain restricted government programs). However, we can try to influence

[28]Given that our sample has a higher socioeconomic status than that of Canada as a whole — and SES has been shown to be negatively related to ethnocentrism and positively related to knowledge — our findings may be conservative relative to what would be found for a representative sample.

intergroup relations by changing perceptions of where people live, particularly about geographies in which they have a vested interest, like their communities. It is, of course, not an easy task to change people's fixed attitudes (Kuklinski et al., 2000; Lawrence and Sides, 2014), but it is more feasible than convincing ordinary citizens to give up autonomy over their residential choices.[29] From a scientific perspective, we can apply what we know about information processing more broadly to our understanding of geography and intergroup relations: pseudoenvironments enhance the relevance of psychology for the study of political geography.

For some outcomes, it is possible that the causal arrow could point in either direction; for example, individuals who are more ethnocentric and/or feel more threatened may "see" more outgroup members in their local community as a result. However, regardless of motivated reasoning, it would be difficult to argue that one's choice to vote makes someone perceive more minorities, especially compared to another respondent who lives in a very similar context. Furthermore, across a wide range of attitudes, there is a consistent pattern of results: given two identically-situated individuals of very similar backgrounds, the person who perceives more outgroup members living in her subjectively defined local community has, on average, more negative reactions to others in her community, more concerns about her safety, and more negative affect about where she lives.

What about self-selection? The research design of this paper does not require random selection of neighborhoods by people (or random assignment of people to neighborhoods) let alone random assignment of perceptions to minds. People do not choose where to live at random; both racial and economic segregation are pronounced across Canada — and our multivariate balance assessment offers dramatic evidence that where a person lives is very highly correlated with many other aspects of that person. Similarly, it is safe to assume that more and less racist individuals have different considerations about what makes a neighborhood "good" or not. People do self-select where they live, but matching individuals on the demographic make-up of their choice of residence allows us to isolate

[29]While we have been comparing individuals who perceive more diversity to those who perceive less, we want to stress that respondents within each match whose pseudoenvironments are less diverse are not necessarily accurate in their perceptions. In fact, they overestimate the numbers of minorities in their community by 10 percentage points on average (and their counterparts overestimate by 35 percentage points on average). Everyone could benefit from greater knowledge.

the impact of pseudoenvironments from the impact of objective environments.[30] An experiment randomly assigning perceptions into the heads of individuals would isolate the perceptions-to-attitude relationship from *all* other background factors. However, in this paper, we ask a simpler question: if two people live in nearly identical neighborhoods, but one *perceives* his neighborhood as being much more diverse, will they react differently? We are able to tease out more about the mechanism by which context affects individuals without requiring isolation from all possible other effects. It is also worth pointing out that self selection does not entirely determine perceptions. In other words, people who see more outgroup members (and who may be more fearful) are not actually selecting into more homogeneous communities than their counterparts who see fewer minorities. After all, we see great diversity in perceptions even after implementing our different designs aiming to compare people in nearly identical contexts.

While scholars of racial context have always been aware of selection biases, our results highlight the extent of homophily. Among non-visible minorities in English Canada, once one accounts for the numbers of visible minorities in the DAs in which they live, any relationships between their objective context and their individual characteristics have been removed. Although it was useful for us analytically, it is, however, disheartening from a normative perspective that the birds that flock together share feathers of education *and* age *and* tenure *and* definitions of community.[31]

[30] It would be much more difficult to isolate the effect of objective environments from the impact of self-selection.

[31] It is possible that with a representative sample of Canada — which would include more young people, VM, women, and people with lower SES who may not have the ability to choose where they live quite so freely — ethnic context might not be so tightly linked with demographic characteristics. We will be exploring this more, both in Canada and in other countries.

References

Aizlewood, Amanda and Ravi Pendakur. 2005. "Ethnicity and social capital in Canada." *Canadian Ethnic Studies* 37(2):77.

Alesina, A. and E. La Ferrara. 2000. "Participation in Heterogeneous Communities." *Quarterly Journal of Economics* 115(3):847–904.

Alesina, Alberto and Eliana La Ferrara. 1999. Participation in heterogeneous communities. Technical report National bureau of economic research.

Alesina, Alberto and Eliana La Ferrara. 2002. "Who trusts others?" *Journal of public economics* 85(2):207–234.

Bafumi, Joseph and Andrew E Gelman. 2006. "Fitting multilevel models when predictors and group effects correlate.".

Bates, Douglas M. 2010. "lme4: Mixed-effects modeling with R." *URL http://lme4. r-forge. r-project. org/book* .

Bates, Douglas, Martin Maechler, Ben Bolker and Steven Walker. 2014. *lme4: Linear mixed-effects models using Eigen and S4*. R package version 1.1-7.
URL: *http://CRAN.R-project.org/package=lme4*

Blalock, H.M. 1967. *Toward a theory of minority-group relations*. Wiley.

Bouchard, Gérard. 2008. *Building the Future, a Time for Reconciliation: Report*. Commission de consultation sur les pratiques d'accomodement reliées aux différences culturelles.

Brewer, Marilynn B. 1999. "The psychology of prejudice: Ingroup love and outgroup hate?" *Journal of social issues* 55(3):429–444.

Citrin, Jack and John Sides. 2008. "Immigration and the imagined community in Europe and the United States." *Political Studies* 56(1):33–56.

Costa, Dora L and Matthew E Kahn. 2003. "Civic engagement and community heterogeneity: An economist's perspective." *Perspective on Politics* 1(01):103–111.

Coulton, C.J., J. Korbin, T. Chan and M. Su. 2001. "Mapping residents' perceptions of neighborhood boundaries: a methodological note." *American journal of community psychology* 29(2):371–383.

Dinesen, Peter Thisted and Kim Mannemar Sønderskov. 2012. "Trust in a time of increasing diversity: on the relationship between ethnic heterogeneity and social trust in Denmark from 1979 until today." *Scandinavian Political Studies* 35(4):273–294.

Enos, Ryan D. 2014. "Causal effect of intergroup contact on exclusionary attitudes." *Proceedings of the National Academy of Sciences* 111(10):3699–3704.

Fearon, James D. 2003. "Ethnic and cultural diversity by country*." *Journal of Economic Growth* 8(2):195–222.

Fieldhouse, Edward and David Cutts. 2010. "Does diversity damage social capital? A comparative study of neighbourhood diversity and social capital in the US and Britain." *Canadian Journal of Political Science* 43(02):289–318.

Frey, Bruno S and Benno Torgler. 2007. "Tax morale and conditional cooperation." *Journal of Comparative Economics* 35(1):136–159.

Frey, Bruno S and Stephan Meier. 2004. "Social comparisons and pro-social behavior: Testing" conditional cooperation" in a field experiment." *American Economic Review* pp. 1717–1722.

Garling, T. and R.G. Golledge. 2000. Cognitive mapping and spatial decision-making. In *Cognitive mapping: Past, Present and Future*, ed. R. Kitchin and S. Freundschuh. Routledge p. 44.

Grannis, R. 1998. "The Importance of Trivial Streets: Residential Streets and Residential Segregation." *American Journal of Sociology* 103(6):1530–1564.

Green, Donald P, Dara Z Strolovitch and Janelle S Wong. 1998. "Defended Neighborhoods, Integration, and Racially Motivated Crime 1." *American Journal of Sociology* 104(2):372–403.

Habyarimana, James, Macartan Humphreys, Daniel N Posner and Jeremy M Weinstein. 2007. "Why does ethnic diversity undermine public goods provision?" *American Political Science Review* 101(04):709–725.

Hansen, B.B. and J. Bowers. 2008. "Covariate Balance in Simple, Stratified and Clustered Comparative Studies." *Statistical Science* 23:219.
URL: *doi:10.1214/08-STS254*

Hopkins, D.J. 2010. "Politicized places: Explaining where and when immigrants provoke local opposition." *American Political Science Review* 104(01):40–60.

Key, V. 1949. *Southern politics in State and Nation*. University of Tennessee Press.

Kuklinski, J.H., P.J. Quirk, J. Jerit, D. Schwieder and F. Robert. 2000. "Misinformation and the Currency of Democratic Citizenship." *Journal of Politics* 62(3).

Kwan, Mei-Po. 2012. "The uncertain geographic context problem." *Annals of the Association of American Geographers* 102(5):958–968.

Lawrence, Eric D and John Sides. 2014. "The consequences of political innumeracy." *Research & Politics* 1(2):2053168014545414.

Lippmann, W. 1922 [1991]. *Public opinion*. Transaction Publishers.

Lu, B., R. Greevy, X. Xu and C. Beck. 2011. "Optimal nonbipartite matching and its statistical applications." *The American Statistician* 65(1):21–30.

Lu, Bo, Elaine Zanutto, Robert Hornik and Paul R Rosenbaum. 2001. "Matching with doses in an observational study of a media campaign against drug abuse." *Journal of the American Statistical Association* 96(456):1245–1253.

Lynch, K. 1973. *The image of the city*. MIT press.

Marschall, M.J. and D. Stolle. 2004. "Race and the city: Neighborhood context and the development of generalized trust." *Political Behavior* 26(2):125–153.

Matei, S., S.J. Ball-Rokeach and J.L. Qiu. 2001. "Fear and misperception of Los Angeles urban space." *Communication Research* 28(4):429–463.

Meer, Tom van der and Jochem Tolsma. 2014. "Ethnic Diversity and Its Effects on Social Cohesion." *Annual Review of Sociology* 40:459–478.

Nadeau, R., R.G. Niemi and J. Levine. 1993. "Innumeracy about minority populations." *Public Opinion Quarterly* 57(3):332–347.

Newman, Benjamin J, Todd K Hartman and Charles S Taber. 2012. "Foreign language exposure, cultural threat, and opposition to immigration." *Political Psychology* 33(5):635–657.

Oliver, J.E. and T. Mendelberg. 2000. "Reconsidering the environmental determinants of white racial attitudes." *American Journal of Political Science* 44:574–589.

Posner, Daniel N. 2004. "Measuring ethnic fractionalization in Africa." *American journal of political science* 48(4):849–863.

Putnam, Robert D. 2007. "E pluribus unum: Diversity and community in the twenty-first century the 2006 Johan Skytte Prize Lecture." *Scandinavian political studies* 30(2):137–174.

Rosenbaum, Paul. 2009. "Design of Observational Studies." Unpublished book manuscript.

Rubin, Donald B. and Neal Thomas. 2000. "Combining Propensity Scandinavianore Matching with Additional Adjustments for Prognostic Covariates." *Journal of the American Statistical Association* pp. 573–585.

Sampson, R.J., S.W. Raudenbush and F. Earls. 1997. "Neighborhoods and violent crime: A multilevel study of collective efficacy." *Science* 277(5328):918.

Sheikh, Munir. 2013. "Canada Has Lost Its Census Anchor." *The Globe and Mail* .
URL: *http://www.theglobeandmail.com/commentary/canada-has-lost-its-census-anchor/article11795465/*

Sigelman, L. and R.G. Niemi. 2001. "Innumeracy about Minority Populations: African Americans and Whites Compared." *Public opinion quarterly* 65(1):86–94.

Smith, H.L. 1997. "Matching with Multiple Controls to Estimate Treatment Effects in Observational Studies." *Sociological Methodology* 27:325–353.

Stolle, D., S. Soroka and R. Johnston. 2008. "When does diversity erode trust? Neighborhood diversity, interpersonal trust and the mediating effect of social interactions." *Political Studies* 56(1):57–75.

Svendsen, E., L. Campbell and D. Fisher. 2008. Understanding urban environmental stewardship in New York City. In *Proceedings of the international symposium on society and resource management (ISSRM): Past and future*. pp. 10–14.

Svendsen, E.S. and L.K. Campbell. 2008. "Urban ecological stewardship: understanding the structure, function and network of community-based urban land management." *Cities and the Environment* 1(1):1–31.

Thompson, D. 2010. "The politics of the census: lessons from abroad." *Canadian Public Policy* 36(3):377–382.

Tversky, B. 2000. Remembering spaces. In *The Oxford handbook of memory*, ed. E. Tulving and F. Craik. Oxford University Press pp. 363–378.

Uslaner, Eric M. 2012. *Segregation and Mistrust: Diversity, Isolation, and Social Cohesion*. Cambridge University Press.

Wong, Cara. 2007. "" Little" and" Big" Pictures in Our Heads: Race, Local Context, and Innumeracy about Racial Groups in the United States." *Public Opinion Quarterly* 71(3):392.

Wong, Cara, Jake Bowers, Tarah Williams and Katherine Simmons. 2012. "Bringing the Person Back In: Boundaries, Perceptions, and the Measurement of Racial Context." *Journal of Politics* 74(4).

Wong, David. 2009. "The modifiable areal unit problem (MAUP)." *The SAGE handbook of spatial analysis. SAGE Publications. Los Angeles, California, USA* pp. 105–123.

Appendix

Design Details

The MLCC Study involved roughly 7100 English speaking Canadians spread across all the provinces of Canada. We worked to isolate comparisons based on perceptions of the percent visible minority (VM) in local areas from Census measurements of percent VM in local areas in two ways: by matching people into pairs based on the percent VM in the Canadian Census dissemination area (DA) and by restricting comparisons to people who lived in the same DA.[1]

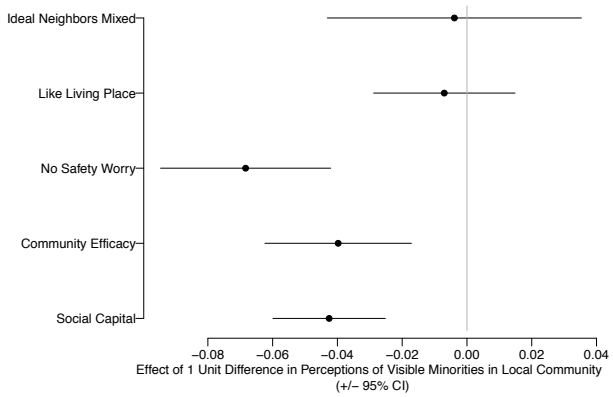
In order to find the best matches possible, we allowed the matching algorithm to choose between 1 and 501 respondents to delete (in intervals of 10, so dropping 1, 11 ...501): in essence we asked the algorithm to exclude the worst matches. We wanted to minimize the difference in objective context within the match, maximize balance across a set of covariates, and minimize the number of cases dropped.

In the first design, we also strongly penalized matches that would compare people from small towns to people living in large cities, and the municipal-level population was one of the covariates that we assessed for balance after this matching.

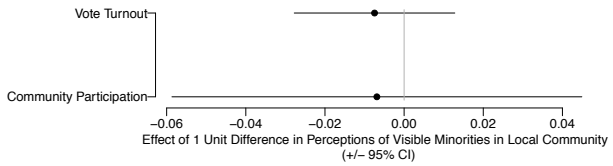
Matching on Visible Minority in the DA, Perceptions of Own Local Community.

This design compared perceptions of context with subjective boundaries within pairs matched on objective context. That is, the "effect of perceptions" in this design was defined as a comparison of perceptions of the ethnic composition of the local community maps drawn by the respondents. Before matching in this design, we excluded the roughly 2190 respondents who did not draw a map or report on their perception of visible minorities in their map. We dropped 31 respondents in order to ensure the best matches.

[1] This document can be rebuilt from the command line using only free, open-source software by downloading the reproduction archive.



(a) Social Capital

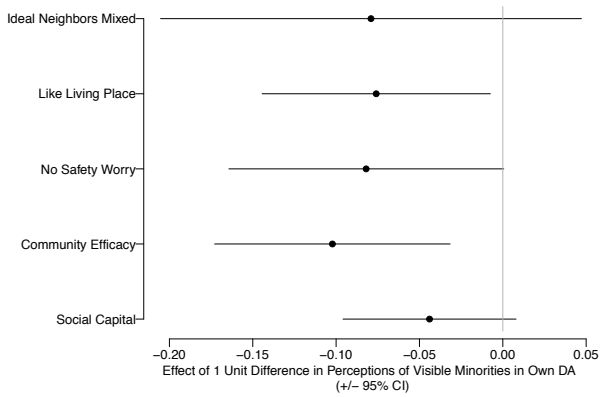


(b) Voting and Participation

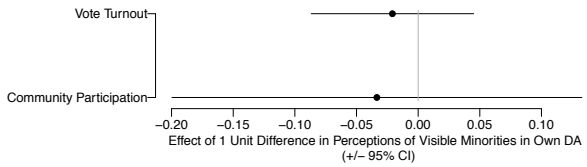
Figure 1: Average differences in outcome between the person perceiving more and the person perceiving fewer visible minorities in their own hand-drawn maps within pairs matched on % VM in DA penalized by Municipal Population. Estimates (black dots) from multilevel models with crossed random effects for dissemination area and matched pair. Approximate confidence intervals (horizontal lines) from a profiled likelihood approach (Bates et al., 2014*a*,*b*).

Matching on Visible Minority in the DA, Perceptions of Own DA.

This design assessed the effect of perceptions by comparing reported percent visible minorities by respondents who were shown their Census DA as a polygon overlaid on a Google map. Since we randomly assigned roughly 1/6 of the sample to be exposed to and report on their DA (and other sixths to see and report on other census geographies), and because we excluded respondents who did not answer the perceptions question, this design used roughly 720 respondents. We dropped 70 cases in order to ensure the best matches possible, and we included a penalty for CSD population again.



(a) Social Capital

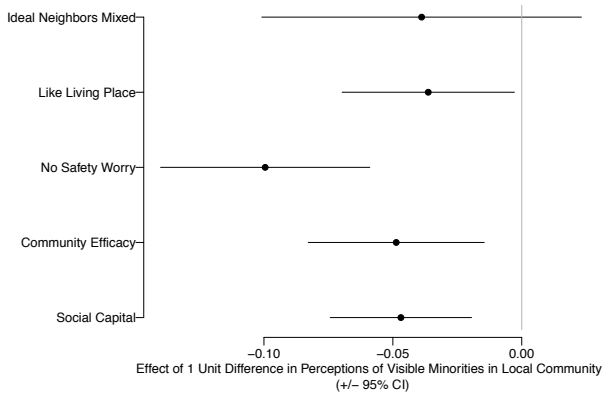


(b) Voting and Participation

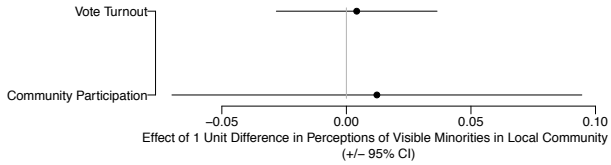
Figure 2: Average differences in outcome between the person perceiving more and the person perceiving fewer visible minorities in their own census DA within pairs matched on % VM in DA penalized by Municipal Population. Estimates (black dots) from multilevel models with crossed random effects for dissemination area and matched pair. Approximate confidence intervals (horizontal lines) from a profiled likelihood approach (Bates et al., 2014*a*,*b*).

Exact matching on DA, Perceptions of own Local Community

This design assessed the effect of pseudoenvironments by comparing perceptions of their own local communities by people who lived in the same DA. The MLCC study had about 1250 respondents who shared a DA with at least one other respondent and who had valid perceptions-of-their-own-maps data.



(a) Social Capital

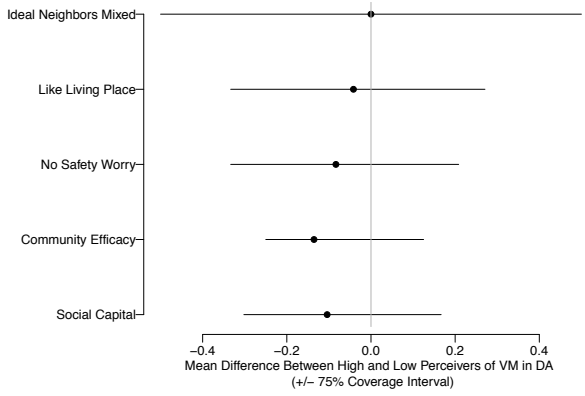


(b) Voting and Participation

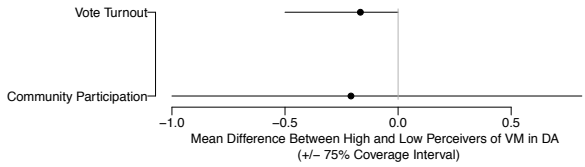
Figure 3: Average differences in outcome between the person(s) perceiving more and the person(s) perceiving fewer visible minorities in their own hand-drawn map within groups (mostly pairs) living in the same dissemination area. Estimates (black dots) from multilevel models with random effects for dissemination area. Approximate confidence intervals (horizontal lines) from a profiled likelihood approach (Bates et al., 2014*a*,*b*).

Exact matching on DA, Perceptions of DA

This design assessed the effect of subjective context by comparing perceptions of the census DA between people living in the same DA. That is, in this design we have people living in the same census location and evaluating the same census object. The MLCC study included 26 people with these characteristics in 13 DAs. The plots below show the mean differences in outcomes between the high and low perceiving person and the intervals containing 75% of these differences for the 13 DAs.



(a) Social Capital

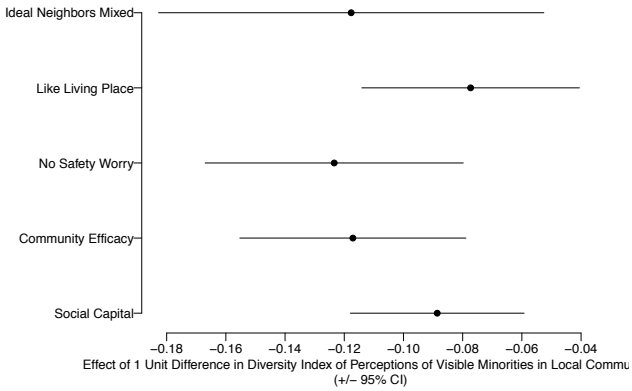


(b) Voting and Participation

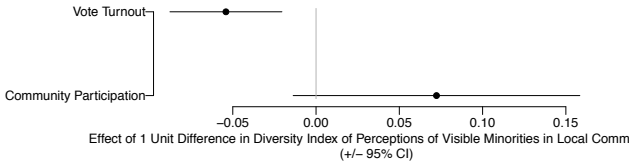
Figure 4: Average differences in outcome between the person perceiving more and the person perceiving fewer visible minorities in the dissemination areas in which both people live. Intervals show the range of the central 75% of the paired differences. Dots show the means of the paired differences.

Matching on Fractionalization Score of DA, Fractionalization Score of Perceptions of Own Local Community

This design assessed the effect of subjective context by comparing fractionalization scores created from perceptions of people's own local communities. The matches were created by pairing people living in DAs with very similiar fractionalization scores. Before matching in this design, we excluded the roughly 2190 respondents who did not draw a map or report on their perception of visible minorities in their map. We penalized matches that differed in CSD population size, and we added an additional penalty for matches that differed by more than 10 percent points in the percentage of Visible Minorities in the DA. We dropped 71 respondents in order to ensure the best matches.



(a) Social Capital



(b) Voting and Participation

Figure 5: Average differences in outcome between the person perceiving more and the person perceiving fewer visible minorities in the dissemination areas in which both people live. Estimates (black dots) from multilevel models with crossed random effects for dissemination area and matched pair. Approximate confidence intervals (horizontal lines) from a profiled likelihood approach (Bates et al., 2014*a*,*b*).

References

Bates, Douglas, Martin Maechler, Ben Bolker and Steven Walker. 2014*a*. *lme4: Linear mixed-effects models using Eigen and S4*. R package version 1.1-7.
URL: *http://CRAN.R-project.org/package=lme4*

Bates, Douglas, Martin Maechler, Benjamin M. Bolker and Steven Walker. 2014*b*. "lme4: Linear mixed-effects models using Eigen and S4.". ArXiv e-print; submitted to *Journal of Statistical*

Software.
URL: *http://arxiv.org/abs/1406.5823*