The Socio-Ecological Psychology of Upward Social Mobility

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Acknowledgements

We thank Hyewon Choi for providing us with various individual difference measures used in Studies 3-5 and Jordan Axt, Hyewon Choi, Samantha Heintzelman, Kostadin Kushlev, Brandon Ng, Lorien Rice, Jane Tucker, Erin Westgate, Tim Wilson, and Nadia Danienta for their assistance with data collection, comments, and feedback.

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Abstract

Intergenerational upward economic mobility--the opportunity for children from poorer households to pull themselves up the economic ladder in adulthood--is a hallmark of a just society. In the U.S, there are large regional differences in upward social mobility. The present research examined why it is easier to get ahead in some cities and harder in others. We identify the “walkability” of a city, how easy it is to get things done without a car, as a key factor in determining the upward social mobility of its residents. We first identify the relationship between walkability and upward mobility using tax data from approximately ten million Americans born between 1980 and 1982. We find that this relationship is linked to both economic and psychological factors. Using data from the American Community Survey from over 3.66 million Americans, we show that residents of walkable cities are less reliant on car-ownership for employment and wages, significantly reducing one barrier to upward mobility. Additionally, in two studies, including one preregistered study (1827 Americans, 1466 Koreans), we find that people living in more walkable neighborhoods feel a greater sense of belonging to their communities, which is associated with actual changes in individual social class.

Keywords: upward mobility, walkability, social ecology

The United States has always been "the land of opportunity," the place where, if you work hard and play by the rules, you'll get ahead (Hochschild, 1996). Upward economic mobility is a valued goal shared widely among Americans (Davidai & Gilovich, 2015; Kraus & Tan, 2015). However, American optimism appears to be in decline (Aaronson & Mazumder, 2008; Stephens, Markus, & Phillips, 2014). A recent New York Times poll, for instance, showed that over 30% of Americans now feel that the American dream is out of reach – the most pessimism since the New York Times started asking the question in 1996 (http://nyti.ms/1zxDn8i). Previous psychological research on upward mobility has centered on the importance of internal individual factors such as intelligence, skills, and motivation, generally finding that being smart and motivated helps people climb up the economic ladder (e.g. Deary, Taylor, Hart, Wilson, Smith, Blane, & Starr, 2005; Snarey & Vaillant, 1985). The present research, by contrast, takes a socio-ecological approach, which explores the interrelationship between people and their lived ecologies (Oishi, 2014; Stokol, 1992; Yamagishi, 2011); here we investigate linkages between the built environment and actual upward mobility.

Regional Variations in Upward Social Mobility in the U.S

Although upward social mobility is generally in decline in the U.S. (Chetty, Grusky, Hell, Hendren, Manduca, & Narang, 2017), it is easier to get ahead in some parts of the United States than others. Using comprehensive tax return data, Chetty, Hendren, Kline, and Saez (2014) found that parts of the country are still fluid – in some areas, such as Pittsburgh, the odds of reaching the top fifth of income in young adulthood (around age 30) for those growing up in households from the bottom income quintile is equal to the most mobile countries in the world. However, in the least fluid areas, such as Charlotte, the odds of rising are three times worse, lower than in any developed country that the authors have data for. Chetty et al. (2014) proposed five factors to explain these regional differences: the area's racial makeup, the level of income inequality, the quality of the K-12 school system, the strength of social capital (measured by voter turnout, the percentage of people who returned their census forms, and various measures of community participation), and the percentage of children living in homes with single parents. These five factors account for a substantial amount of regional variations in upward mobility.

In this paper, we identify a new predictor of economic mobility: the way in which cities are organized. We propose that the walkability of one's area is an important predictor of intergenerational upward mobility. We define walkability as how easily people can live their lives on foot, or using public transportation – in highly walkable areas, a person can go to work, for example, or to their local grocery store without needing a car. In contrast, in less walkable areas, cars are needed for practically every task. In urban planning, geography, and transportation research, walkability is typically measured by physical characteristics such as intersection density and street connectivity, as well as land use (e.g., mixed residential and commercial use) and dwelling density (see Frank et al., 2006). Walkability is associated with urban vibrancy and recreational opportunities (Forsyth, 2015), and walkable cities tend to have better public transportation than less walkable cities.

Why Walkability Matters

Walkability may be associated with higher upward mobility for several reasons. The requirement of car ownership in less walkable cities is a major barrier to the job market for anyone without the means to afford one (Ong & Blumenberg, 1998; Raphael & Rice, 2002). By reducing the need for a car, a more walkable city opens its employment possibilities up to a far wider range of prospective employees than in a less walkable city. Thus, the first reason why we think walkability is associated with upward social mobility is increased access to jobs.

Another pathway to increased upward mobility may run through improved physical health. People living in a walkable city tend to be healthier (Frank et al., 2006; Sallis et al., 2009; Todd et al., 2016; Van Cauwenberg,Van Holle, De Bourdeaudhuij, Van Dyck, & Deforche, 2016). Healthy people are able to work longer hours or on multiple jobs and more likely to move up the economic ladder over time than those less healthy (Power Matthews & Manor, 1996). In addition, walking is associated with better academic achievement (e.g. Hillman, Pontifex, Raine, Castelli, Hall, & Kramer, 2009). To the extent that the walkability of a city is associated with the mean level of physical fitness of its residents and walking is associated with better academic achievement, walkable cities might have higher levels of upward social mobility due in part to physical fitness and academic achievement.

A third pathway is more psychological. In a walkable city, we expect that people from lower socioeconomic strata are more likely to feel a sense of belonging and a sense of place than they would in an unwalkable city. In an unwalkable city, people with lesser means, including reduced access to transportation, will find it harder to get around, and will thus have more limited access to the city as a whole. Unable to reach the totality of the city, they might not necessarily feel a sense of belonging to the city at large, or feel that the whole city is *their* city. A limited sense of belonging might preclude people from lower SES from applying to jobs in certain parts of the city. In contrast, people in a walkable city, able to get wherever they might wish to go, might feel a broader sense of place and a stronger sense of belonging, and therefore apply to jobs in most parts of the city. Feeling like one belongs in a place has been shown to have positive effects on motivation and accomplishment (e.g., Allen, Kern, Vella-Brodrick, Hattie, & Waters, 2018; Baumeister & Leary, 1995; Yeager, Walton, Brady, Akcinar, Paunesku et al., 2016). A sense of belonging is motivating especially among those in disadvantaged circumstances, as it makes people feel that they fit in a community, that their struggle is fairly common to others, and that there are people who will support their efforts (e.g., Shnabel, Purdie-Vaughns, Cook, Garcia, & Cohen, 2013; Walton & Cohen, 2011). If people feel a great sense of belonging to their city, they are likely to apply to jobs outside of their immediate neighborhoods and feel that they could work there. In contrast, if people do not feel a sense of belonging to the city, they might feel that they don't fit in and might not apply to jobs, for instance, in downtown.

The Current Research

The present paper tests whether walkability is positively related to upward social mobility and investigates potential mechanisms. Consistent with our hypotheses, a recent study found that higher degrees of urban sprawl (e.g., % of population living in low-density suburban developments) was negatively associated with upward social mobility across 122 American commuting zones (Ewing, Hamidi, Grace, & Wei, 2016). We expand on that work in our Study 1. Using a broader dataset of 389 commuting zones, with a more focused definition of walkability, and with tighter controls, we test the role of walkability above and beyond Chetty et al.'s (2014) five factors, as well as other related variables. Study 2 uses individual-level data from the American Community Survey to examine whether car ownership plays a role in the link between walkability and upward mobility. Following the research strategies of socio-ecological psychology (Oishi, 2014), the next 2 studies look to individual psychology as a pathway between the environment and its related outcomes. We investigate one's sense of belonging as a key translational mechanism between the ease of getting around and one's ability to climb the socioeconomic ladder.

Study 1

In Study 1, we establish the link between walkability and upward social mobility using the earning records from all American citizens born between 1980 and 1982 whose parents filed taxes (Chetty et al., 2014).

Method

Participants and Materials

Income, demographic, and city-level covariate data for Study 1 largely come from a dataset put together by Chetty et al. (2014), available at Equality-of-Opportunity.org. Data on commuting-zone-area walkability comes from www.walkscore.com. Commuting-zone-level voting data are adapted from Leip (2012). Commuting-zone level longevity at age 40 for the lowest income quarter was taken from https://healthinequality.org/data/.

Intergenerational upward economic mobility was operationalized as the probability of reaching the top fifth of income in young adulthood (at age 30) for those coming from the households in the bottom fifth of the income distribution. Following Chetty et al. (2014), we used the commuting zone of each individual as the grouping variable of choice. Commuting zones (CZs) are "geographical aggregations of counties that are similar to metro areas but cover the entire United States" (Chetty et al., 2014, p. 1555). Because CZs range in population size in 2000 from 1,193 (Murdo, South Dakota) to 16,393,360 (Greater Los Angeles, California), we weighted each of the 741 commuting zones in our regression analyses by population, to take into account the spread of populations within the sample: 62 zones had less than 10,000 residents, while 62 zones had more than 1 million residents. Ordinary least-squares regression (without weighting) would weigh observations with less than 10,000 residents equally with observations with more than 1 million residents. To infer the U.S. as a whole, it is therefore important to weigh observations by their populations.

Our walkability data comes from www.walkscore.com, a well-validated measure of the walkability of an area (Carr, Dunsiger, & Marcus, 2011; Duncan, Aldstadt, Whalen Melly, & Gortmaker, 2011). A Walkscore is computed based on access to various amenities (e.g., restaurant, bank, post office) and physical factors such as population density, block length and intersection density. Walkscores range from 0 to 100. We were able to obtain walkability scores for 389 commuting zones, which contain 8.98 million individuals for whom we have intergenerational mobility information.

Results and Discussion

First, the population weighted simple regression showed that upward social mobility was substantially higher in more walkable commuting zones than less walkable commuting zones, $b = .00050$, $SE = .000060$, $\beta = .39$, t (387) = 8.33, $p < .001$, effect size $r = .390$.

Furthermore, weighted multiple regression showed that the association between walkability and upward mobility remained significant, even after entry of the factors previously found to impact upward social mobility (Chetty et al., 2014) - percentage of African Americans, degree of income inequality, quality of K-12 education, social capital, and percentage of children with single mothers [the Five Factors]. The effect size for walkability was substantial: walkability explained 11% of additional variance uniquely beyond the previously identified Five Factors (R^2 with walkability = .52, R^2 without walkability = .41), $b = .00049$ $SE = .00053$, $\beta = .389$, t (376) = 9.278, $p < .001$, $\Delta R^2 = .11$.

Alternate Explanations

There are several potential alternate explanations for our primary findings above. First, walkable cities might be more politically liberal than less walkable cities, and liberal policies (e.g., more generous welfare) in walkable cities might be responsible for the association between walkability and upward social mobility. Thus, we ran another weighted regression predicting upward mobility from walkability, the Five Factors, and the percentage of voters in a commuting zone who voted for the Democratic candidate in the 1996 presidential election (when these participants were in their teens, as the political climates when they were growing up would be more relevant to their ultimate economic mobility as adults than the current political climate[1]). Walkability remained a significant predictor above and beyond the Five Factors and the percentage of Clinton voters in 1996, $\beta = .258$, t (375) = 4.873, $p < .001$, $\Delta R^2 = .029$.

Walkable cities are healthier. Indeed, longevity estimates for the poorest quarter of the population was longer in more walkable cities, r (386) = .335, $p < .001$. The older that residents from the poorest quarter of a city were expected to live, the more likely that children of the poor parents moved up the economic ladder as adults, r (368) = .348, $p < .001$. Thus, we next ran another weighted regression predicting upward mobility from walkability, the Five Factors, and longevity. Walkability remained a significant predictor above and beyond the Five Factors and longevity, $\beta = .200$, t (374) = 4.275, $p < .001$, $\Delta R^2 = .020$.

Walkable cities are also different from less walkable cities in terms of economic conditions, labor structure, education spending, religiosity and various other factors. To test robustness of the walkability findings, we conducted a series of additional weighted multiple regression analyses, controlling for the Five Factors plus household median income, percentage of religious people, share of manufacturing as a source of employment, state income tax

[1] It should be noted that walkability effect remained a significant predictor even when we used election data from different years: controlling for the percentage of Democratic votes in 2012, $\beta = .369$, t (375) = 6.505, $p < .001$; controlling for the percentage of Democratic votes in 2008, $\beta = .393$, t (375) = 7.048, $p < .001$; controlling for the percentage of Democratic votes in 2004, $\beta = .338$, t (375) = 5.946, $p < .001$; controlling for the percentage of Democratic votes in 2000, $\beta = .311$, t (375) = 5.499, $p < .001$; controlling for the percentage of Democratic votes in 1992, $\beta = .291$, t (375) = 6.225, $p < .001$; controlling for the percentage of Democratic votes in 1988, $\beta = .263$, t (375) = 5.789, $p < .001$; controlling for the percentage of Democratic votes in 1984, $\beta = .285$, t (375) = 6.055, $p < .001$.

progressivity, local government expenditure per capita, and violent crime rate. Controlling for all these variables simultaneously, walkability still remained a significant predictor of upward social mobility, $b = .000314$, $SE = .000066$, $\beta = .239$, t (348) = 4,767, $p < .001$, $\Delta R^2 = .023$. Overall, the walkability of an area was a robust predictor of upward social mobility beyond factors previously used to explain upward mobility as well as other potential third variables such as political culture, economic conditions, and labor structure.

Propensity Score Matching Analysis

In addition to these analyses, we conducted a propensity score matching analysis, an econometric method to strengthen the possible causal inferences from observational data by accounting for potential systematic differences in selected baseline characteristics between groups. Propensity score analyses use a procedure which identifies pairs of cases (one treated and one untreated) in the data with otherwise matched baseline characteristics (Rubin & Thomas, 1996). These paired sets are then subjected to a t-test to determine whether the treatment (in this case, walkability) is related to the outcome (in this case, upward intergenerational economic mobility) even after the baseline characteristics are matched away. We chose to match our commuting zones on their population, urbanity (coded as urban or not urban, taken from Chetty et al., 2014), and their number of historic buildings (as the cities with more historic properties [defined as the properties registered in the Nation's historic places by the National Park Service, see https://www.nps.gov/nr/research/ for the list] are likely older and have a denser urban core) as proxies for baseline urban structure in order to better isolate the effect of walkability specifically. We first created a propensity score using a logistic regression analysis, in which the dichotomized walkability score was regressed on population, urbanity, and the number of historic buildings. Out of 377 CZs that had the data on walkability and three matching variables, we were able to find 125 pairs of CZs (i.e., 250 CZs) that were matched on our three variables (propensity score threshold <.10) but differ in terms of walkability. As predicted, a paired t-test showed that walkable cities (M = .0978, SE = .0313) had higher upward social mobility than matched unwalkable cities (M = .0837, SE = .0404), t (124) = 3.539, p = .001, d = .321. Furthermore, a general linear model analysis, in which upward social mobility was the within-factor and the Five Factors were covariates, showed that upward social mobility was higher for walkable than matched unwalkable cities, additionally controlling for the Five Factors, F (1, 116) = 4.143, p = .044, ΔR^2 = .034. Thus, the propensity score matching analyses also showed that upward social mobility is higher in walkable than less walkable cities.[2]

Using tax data from almost nine million Americans born between 1980 and 1982, Study 1 demonstrates that upward social mobility is substantially higher in more walkable areas (r = .390). The more walkable an area is (as indexed by Walkscore.com), the more likely an American whose parents were in the lowest income quintile is to have reached the highest income quintile by their 30s. This relationship holds above and beyond factors previously used to explain upward mobility such as income inequality and social capital, and is robust to various political, economic, and demographic controls, to alternate specifications of upward mobility, and to potentially unspecified third variables.

Study 2

In Study 2, using data from the American Community Survey (ACS) on over 3.66 million Americans, we examine one potential mechanism for the association between walkability and

[2] We additionally conducted an instrumental variable analysis, using the number of historical buildings in a CZ as our instrument of choice. The results are consistent with the other analyses here, and can be found in the SI

upward social mobility: the possibility that, in more walkable cities, a car is less important for finding a good job.

Method

Participants

We used data from the 2009-2013 American Community Survey (ACS), a product of the U.S. Census Bureau which tracks various demographic, housing, economic, and social indicators from a broad, representational sample of the American population (https://www.census.gov/programs-surveys/acs/), supplemented with data from the U.S. Census and the Bureau of Labor Statistics. We have complete data for over 3.66 million Americans from 305 metro areas. Walkability scores for each metro area come from www.walkscore.com.

Results and Discussion

To test our hypothesis that employment is less dependent on car ownership in walkable cities than less walkable cities, we conducted a multi-level analysis (Level 1 = respondents; Level 2 = cities), using HLM 6.04. On average, car ownership was associated with a 1.16 increase in log (p/(1-p)) employment, t (5,402,596) = 161.85, $p < .001$, Odds Ratio (OR) = 3.17, 95% confidence interval = [3.13, 3.22], or a 26.04% employment advantage over those without a car. However, as predicted, the association between car ownership and employment status was significantly smaller in walkable cities than in less walkable cities, $b = -.011$, $SE = .00025$, t (5,402,596) = -43.34, $p < .001$, OR = .989, [.988, .989]. In a city with a walkability score one standard deviation above the mean, car ownership was associated with a 1.00 increase in log (p/(1-p)) employment (a 23.03% employment advantage), while in a city with a walkability score one standard deviation below the mean, car ownership was associated with a much larger 1.31 increase in log (p/(1-p)) employment (a 28.82% employment advantage).

Employment status, however, is also associated with various individual factors (e.g., age, years of education), and the link between car ownership and employment may plausibly be moderated by city-level factors such as the city's cost of living (indexed by the median income of the city), in that it may be more expensive for everyone to own a car, thus dampening the relationship between car ownership and employment; or the city-wide employment rate: where there is less competition for any given job, it may be easier to get a job without a car. Thus, in the next analysis, we statistically controlled, at the individual-level, for gender, race, age, years of education, student-status, and the presence of an infant at home, as well as for commuting-zone-level population size, median income, and unemployment rate. The results were largely unchanged: car ownership was associated with a .81 increase in log (p/(1-p)) employment, a 19.15% employment advantage, $SE = .0107$, $t\,(3{,}664{,}221) = 74.97$, $p < .001$, OR = 2.24, [2.19, 2.29], which, again, was moderated by walkability, $b = -.0083$, $SE = .00046$, $t\,(3{,}664{,}221) = -17.80$, $p < .001$, OR = .992, [991, .993]. That is, controlling for a host of variables, car ownership was associated with a 21.60% employment advantage in a less walkable city (-1SD), whereas car ownership was associated with a 16.59% employment advantage in a walkable city (+1SD).

[Table 1 about here]

What about Wages?

Employment itself, though necessary for economic mobility, is far from sufficient; one must get a well-paying job, not just any job. Thus, we next tested whether wages are less dependent on car-ownership in walkable than unwalkable cities. We further analyzed the data from respondents who reported having a job and received a wage (we excluded respondents who said they had a job, but reported having zero wages).

First, we ran the simplest model, in which one's wage (log transformed) was predicted from car-ownership at Level 1 (within city), and the intercept and the slope for car-ownership were predicted from walkability at Level 2 (between cities). Not surprisingly, car-ownership was associated with a higher wage, $b = .59$, $SE = .012$, t (4,637,163) = 155.17, $p < .001$. Given the intercept was 9.63, the coefficient of .59 here translates into car owners' annual wage being roughly $27,406 as opposed to non-car owners' annual wage of roughly $15,214, an approximately $12k advantage. Importantly, the car ownership advantage was significantly smaller in walkable than less walkable cities, $b = -.0049$, $SE = .00012$, t (4,637,163) = - 40.81, $p < .001$. In a less walkable city (-1SD), the wage advantage for car owners was roughly $14k, whereas in a walkable city (+1SD), the wage advantage for car owners was smaller, roughly only $10k. Using the same set of controls as in the analysis of employment, the moderation role of walkability remained significant, $b = -.0038$, $SE = .00018$, t (3,161,012) = -21.01, $p < .001$.

Using data from approximately 3.66 million Americans, we find that car ownership is a higher barrier to entry into the job market in less walkable cities. Even after controlling for a host of demographics, we found that owning a car was more important for employment in a less walkable city than in a more walkable one, and that non-car owners in more walkable cities were less disadvantaged in their average wages than non-car owners in less walkable cities. Study 2's findings suggest that a reason why children from low income families living in walkable cities had a better chance of moving up an economic ladder as adults is that they did not have to rely on a car as much as those living in less walkable cities.

[Table 2 about here]

Study 3

In the first two studies, we showed that walkability predicts upward social mobility, and that the employment status and wages of residents are less dependent on car ownership in walkable than in less walkable cities. In the next two studies, we look at psychological differences between people living in more and less walkable neighborhoods, and at how those differences may be associated with upward social mobility. In Study 3, we examined whether a sense of belonging is such a mechanism.

Method

Participants

This study was presented to participants in a package with other studies, however all relevant materials are reported here and in the SI. This study, and the study following, were approved by the University of Illinois IRB (protocol # 16188). While we originally aimed to recruit 750 participants, an opportunity arose to double our collection, and we took advantage of that opportunity before looking at our data. Our final sample was 1827 participants[3] (53% female; Age *M* = 42.24, *SD* = 12.29). Participants were recruited from a nationally representative panel of Americans maintained by Lightspeed GMI. The preregistration for this study can be found at https://osf.io/4mv3t/register/565fb3678c5e4a66b5582f67?view_only=d4bd7df3065b42679a57db30b57f18ea

Materials and Procedure

We measured participants' perceived walkability of their current place of residence and the surrounding areas using one dimension (Land-Use Mix Diversity) of a widely used self-

[3] We originally preregistered the use of an attentional filter, which 1680 participants passed. However, since the results of our analyses do not differ between a filtered and an unfiltered sample, we report here the more complete data.

report measure of walkability, the Neighborhood Environment Walkability Scale-Abbreviated (NEWS-A; Cerin, Saelens, Sallis, Frank, 2006). Assessment of land-use mix diversity was chosen while other factors, such as street connectivity, were excluded because this dimension best captured our definition of walkability (ability to walk to get things done in everyday life). Participants reported on a 5-point scale whether they could go to each of nine places by walking (1 = less than 5 min walk, 2 = 6-10 min walk, 3 = 11-20 min walk, 4 = 21-30 min walk, 5 = over 30 min walk or can't walk): to a job or school they attend, and to a supermarket, restaurant, gym or fitness center, library, post office, park, coffee/tea place, bank or ATM machine. It was reverse scored so that higher scores indicate greater walkability (M = 2.33, SD = .99; α= .89). We also asked participants to indicate how often they walked to each of these places (1 = almost always, 2 = usually, 3 = occasionally, 4 = rarely, 5 = not at all; M = 1.81, SD = 1.04; α = .94). We reverse scored so that higher scores indicate more walking.

We measured participants' sense of belonging by asking them on a 5-point scale (1 = strongly disagree, 5 = strongly agree) the degree to which they agree with the following item: "I feel a sense of belonging in my community" (Su, Tay, & Diener, 2014; M = 3.31, SD = 1.18).

Upward social mobility was obtained by comparing the current reported SES of participants with that reported of their parents when participants were growing up, measured on a 5-point scale (1 = lower/working, 2 =lower middle, 3 = middle, 4 = upper middle, 5 = upper). Parents' social class rating was subtracted from participants' current social class, and this score was used as an index for upward social mobility, with higher scores indicating greater actual mobility (M = -.08, SD = 1.05). Demographic questions including gender, age, race, highest level of education, employment status, and annual household income were asked at the end of Study 3.

The exact wording for all items can be found at https://osf.io/qhdjr/?view_only=d4bd7df3065b42679a57db30b57f18ea

Results & Discussion

As expected, perceived walkability and actual frequency of walking were positively correlated, $r(1825) = .54$, $p < .001$, indicating that people who live in walkable neighborhoods do indeed walk more. Because the size of the correlation is far from perfect, we conducted the same set of analyses for walkability and frequency of walking separately.

Walkability, sense of belonging, and upward social mobility. Unlike Study 1, there was no direct relationship between walkability and upward mobility, $r(1811) = -.013$, $p = .581$. Despite the lack of the direct association, we went on to explore the mediation analyses below because some prominent methodologists and researchers have pointed out that a direct association is not a necessary condition for mediation and indeed recommend dispensing the direct effect as a requirement for mediation (e.g., MacKinnon, 2008; Rucker, Preacher, Tormala, & Petty, 2011; Shrout & Bolger, 2002). Conceptually, the lack of the direct association between walkability and upward social mobility at the level of individuals could be driven by unmeasured suppressor variables. For example, income inequality and air pollution are both likely to be positively associated with walkability (Marshall, Brauer, & Frank, 2009) and are also likely to be negatively associated with upward social mobility (Chetty et al., 2014).

As predicted, the more walkable one's residential area is, the greater sense of belonging the person is likely to experience, $r(1819) = .127$, $p < .001$, and the greater sense of belonging one experiences, the more likely the person is to achieve higher social status, $r(1817) = .160$, $p < .001$ (See Table S4 for correlations between key variables including control variables). To test for the indirect effect, we used a bootstrapping procedure (5,000 iterations) with 95% bias-corrected confidence estimates (PROCESS Model 4; Hayes, 2013). This analysis suggested that even after controlling for age, gender (1 = male, 0 = female), race (1 = white, 0 = others), education, employment status, and income, participants who reside in a more walkable place experience a greater sense of belonging, $b = .1640$, $SE = .0281$, $t(1713) = 5.8341$, $p < .001$, $R^2 = .07$, that the greater one's sense of belonging, the more likely a person achieved upward social mobility, $b = .0857$, $SE = .0207$, $t(1712) = 4.1509$, $p < .001$, $R^2 = .16$, and that a sense of belonging mediated the association between walkability and upward social mobility, indirect effect = .0141, [.0064, .0237].

We also tested an alternate hypothesis, that walkability, above and beyond our control variables, would lead to upward social mobility, which would then lead to a sense of belongingness, but found no evidence for that pathway, indirect effect = -.0014, [-.0071, .0042].

Frequency of walking, sense of belonging, and upward social mobility. We found similar results when we substituted frequency of walking for walkability.

Like perceived walkability, frequency of walking was not correlated with upward social mobility, $r(1815) = .002$, $p = .947$. However, we found that the more frequently one tends to walk, the greater sense of belonging the person is likely to experience, $r(1824) = .165$, $p < .001$. We then tested for mediation with possible confounding variables using a bootstrapping procedure (5,000 iterations) with 95% bias-corrected confidence estimates (PROCESS Model 4; Hayes, 2013) and found evidence that frequency of walking enhances upward social mobility mediated through a sense of belonging above and beyond other control variables, indirect effect = .0160, [.0077, .0263]. That is, participants who tend to walk more (vs. less) often to nearby places tend to experience a greater sense of belonging, $b = .1825$, $SE = .0276$, $t(1718) = 6.6112$, $p < .001$, $R^2 = .07$. The greater sense of belonging one experiences, the more likely the person is to achieve higher social status than his or her parents controlling for the effect of frequency of walking, $b = .0879$, $SE = .0207$, $t(1717) = 4.2503$, $p < .001$, $R^2 = .16$.

We also tested the alternate hypothesis that frequency of walking enhances a sense of belonging mediated through upward social mobility above and beyond the control variables but found no evidence for this pathway, indirect effect = -.0016, [-.0077, .0039].

In a preregistered, nationally representative sample of Americans, we found that living in a more walkable neighborhood was associated with stronger feelings of belonging in that neighborhood, and that those feelings themselves were associated with upward social mobility. In short, Study 3 revealed one potential psychological mechanism underlying the association between walkability and upward social mobility.

Study 4

Cross-cultural research has shown that some of the findings from North America and other Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies are not replicated in non-WEIRD samples (Henrich, Heine, & Norenzayan, 2010). Thus, it is important to examine whether the findings of Study 3 in the U.S. would extend beyond the American context. We chose to test the generalizability of our findings in Korea, as personal achievement is tightly linked to success and power in vertical individualistic cultures (such as the U.S.), while they are less tightly linked in more vertical collectivistic cultures (such as Korea) (Torelli & Shavitt, 2010). For instance, family members of a zaibatsu in Japan (e.g., Sumitomo, Mitsui) and a chaebol in Korea (e.g., Samsung) could have power and success, even if their personal achievement is limited. Therefore, it is possible that our key finding that walkability is associated with upward social mobility is only applicable to the US or other individualistic, meritocratic societies and not generalizable to other collectivistic, nepotistic societies.

Method

Participants

Participants were members of Micromill Embrain, a nationwide online research panel in South Korea. Micromill Embrain's panel has more than one million individuals, aged 18 and above, who voluntarily opt-in to be a panel member and receive monetary incentives in return for the completion of surveys. Among the panel members, participants in this study were invited to take part in the survey online in 2016. Data for this study were obtained as part of a larger longitudinal study on social judgment, and this study was presented with other measures that are unrelated to this research. The study involved two waves of online surveys among Korean adults aged 18 years and older. The items related to social mobility were not included in the first round of the survey and were added in the second round. Therefore, we analyzed the data from the second round of the survey. In the first round, among 4,350 participants who received the invitation, 1880 participated in the survey. Of those participants, 1,466 (49.2% female, M_{age} = 41.09 years) completed the survey in the second round (attrition rate 23%).

Materials and Procedure

Participants' perceived walkability of their residential area and actual walking activity was measured as in Study 3 using the land-use mix diversity dimension of the NEWS-A (Cerin et al, 2006; $\alpha = .77$; $M = 3.27$, $SD = .69$), and self-reported walking ($\alpha = .81$; $M = 3.30$, $SD = .76$). Then participants completed a 2-item scale adapted from past research to indicate their sense of belonging to their neighborhood (i.e., "I feel a strong sense of belonging to my neighborhood," "I feel a strong sense of belonging to the city/town I live in now"; (*r*

= .607; Keyes, 1998) on a 6-point scale (1 = strongly disagree, 6 = strongly agree; M = 2.75, SD = .99). As in Study 3, we operationalized participants' upward social mobility by subtracting their current social class from their parents' social class rating with higher scores indicating greater actual mobility (M = .06, SD = .95). Demographic questions including gender, age, education, employment status, and income were asked at the end of Study 4.

Results & Discussion

As in the United States, the perceived walkability of the neighborhood was correlated with actual frequency of walking, albeit more weakly,[4] $r(1464) = .222$, $p < .001$. Thus, we conducted the same set of analyses for walkability and frequency of walking separately.

Walkability, sense of belonging, and upward social mobility. As in Study 3, there was no direct relationship between walkability and upward social mobility, $r(1464) = -.004$, $p = .883$. Also, there was no correlation between walkability and a sense of belonging, $r(1464) = .016$, $p = .540$. However, the greater sense of belonging one experiences, the more likely the person is to achieve higher social status, $r(1464) = .113$, $p < .001$ (See Table S5 for correlations between key variables including control variables). A bootstrapping procedure (5,000 iterations) with 95% bias-corrected confidence estimates (PROCESS Model 4; Hayes, 2013) suggested that controlling for age, gender (1 = male, 0 = female), education, employment status, and income, participants who reside in a more walkable place did not hold a greater sense of belonging, $b = .0527$, $SE = .0405$, $t(1459) = 1.3022$, $p = .1931$, $R^2 = .05$. The greater one's sense of belonging, however, the more likely a person achieved upward social mobility, $b = .0804$, $SE = .0233$,

[4] The weaker correlation may be due to restricted range, as Korea's population is highly concentrated in Seoul and the surrounding areas, which are generally walkable, with an extensive public transportation system.

$t(1458) = 3.4531$, $p < .001$, $R^2 = .05$. In addition, a sense of belonging did not mediate the association between walkability and upward social mobility, indirect effect = .0042, [-.0021, .0134].

Frequency of walking, sense of belonging, and upward social mobility. There was no direct relationship between frequency of walking and upward social mobility, $r(1464) = -.011$, $p = .669$. However, as in Study 3, the more frequently one walks, the greater sense of belonging the person is likely to experience, $r(1464) = .124$, $p < .001$, and the greater sense of belonging one experiences, the more likely the person is to achieve higher social status, $r(1464) = .113$, $p < .001$. A bootstrapping procedure (5,000 iterations) with 95% bias-corrected confidence estimates (PROCESS Model 4; Hayes, 2013) suggested that even after controlling for age, gender, education, employment status, and income, participants who frequently walk are more likely to feel a greater sense of belonging in their neighborhoods, $b = .2022$, $SE = .0361$, $t(1459) = 5.5970$, $p < .001$, $R^2 = .06$. Also, the greater one's sense of belonging, the more likely that one has actually been economically mobile, achieving higher social status than the status their parents had while they themselves were growing up controlling for the effect of the aforementioned demographics and the frequency of walking, $b = .0837$, $SE = .0235$, $t(1458) = 3.5603$, $p < .001$, $R^2 = .05$. We then found that a sense of belonging significantly mediated the relationship between frequency of walking and achieving upward social mobility, indirect effect = .0169, [0071, .0316].

We also tested an alternate hypothesis and found no evidence that frequency of walking enhances a sense of belonging mediated through upward social mobility above and beyond the control variables, indirect effect = -.0019, [-.0106, .0046].

In Study 4, we extend the findings of Study 3 to a new country (Korea). Study 4 shows, in a nationwide sample, that people who frequently walk in neighborhoods feel a greater sense of belonging in those neighborhoods, which is associated with upward socioeconomic mobility. However, unlike Study 3, perceived walkability was not associated with a sense of belonging. The null findings for perceived walkability may be explained by the fact that unlike the US, Korea is a very small and densely populated country, significantly more walkable than the U.S (M_{korea} = 3.24, *SD* = .68; M_{us} = 2.33, *SD* = .99; $t(3225.388) = -30.873$, $p < .001$, Cohen's d = 1.060). Most relevant to our null findings, variance in walkability scores was substantially smaller in Korea than in the U.S. (Levene's test F[3298] = 288.352, $p < .001$, $d = .59$).

[Tables 3 & 4 about here]

General Discussion

From a socio-ecological perspective (Oishi, 2014; Stokol, 1992; Yamagishi, 2011) the current research explored the link between walkability and upward social mobility, and tested whether walkability is associated with greater sense of belonging, which, in turn would be associated with upward social mobility. Whereas much of psychological research on upward social mobility has focused on internal factors such as intelligence and motivation (Deary et al., 2005; Snarey & Vaillant, 1985) we have instead examined the impact of a concrete built environmental factor, walkability.

Using tax records from approximately nine million Americans, in Study 1 we first established that commuting zones with higher walkability also have higher intergenerational upward mobility, and that this relationship is robust to control variables such as political climate and physical health. In Study 2, using data from over 3.66 million Americans, we explored one possible mechanism, finding that employment and wages in walkable cities are less dependent on car ownership. That is, economic success had less to do with car ownership in walkable cities than in less walkable cities. In Studies 3 and 4, we tested a psychological mechanism, whether living in a walkable neighborhood is associated with a greater sense of belonging, which in turn would be associated with upward social mobility. Study 3 found that, although the direct association between walkability and upward social mobility was not significant, those living in a walkable neighborhood and those who walked more in their everyday lives felt a greater sense of belonging, which was in turn associated with upward social mobility. Study 4 was a direct replication of Study 3 in South Korea. We did not find the predicted indirect effect from walkability to sense of belonging to upward social mobility, perhaps due to a smaller variance in walkability. It should be noted that frequency of walking was indeed associated with a greater sense of belonging, which was in turn associated with upward social mobility. In both Studies 3 and 4, the frequency of walking was associated with a greater sense of belonging, which in turn was related to more upward social mobility. Thus, it appears that walking was a more proximal predictor of upward social mobility than walkability of neighborhood per se. In other words, walkability matters (at least in the U.S.) to the extent that it encourages residents to walk more. The more an individual walks, the greater sense of belonging one feels toward city.

Additional Mechanisms

In the current work, we have focused on one intrapsychic mechanism, one's sense of belonging. However, walkability and walking may also impact upward mobility through other, intrapsychic as well as interpersonal means. Imagine people living in a walkable city. In their daily commute, on foot or via public transportation, they will, almost by necessity, run into lots of other people directly engaged in the same commute. By contrast, people in a more unwalkable city, commuting by car, are practically hermetically sealed off from social interaction for the duration of their commute. The social intermingling of a more walkable city brings people together from all socioeconomic strata; the lack of social contact in a more unwalkable city precludes the possibility. In a walkable city, people from lower socioeconomic strata are more likely to see “successful” people in a daily basis, and these repeated interactions may make success feel more attainable, since it is something that they see everyday. It is well-recognized that having positive role models is an important aspect of future success; for instance, when exposed to a successful role model, students estimated that future career goals are more attainable (Lockwood & Kunda, 1997; Lockwood, Shaughnessy, Fortune, & Tong, 2012). In a walkable city, success may seem more attainable and there are many more accessible role models whom struggling people can look up to and emulate. The first hand contact with successful people might inspire people with limited means to work harder and be successful.

Similarly, recent work suggests that walking encourages locomotive motivation, creativity, and forward progress (Webb, Rossignac-Millon, & Higgins, 2017). It might be that living in a walkable neighborhood encourages more walking, which in turn increases locomotion motivation (action-orientation) and creative problem solving. Future work exploring these interpersonal, cognitive, and motivational aspects of highly walkable cities will enhance our understanding of the relation between walkable environments and upward social mobility.

Limitations and Future Directions

We would like to point out several limitations of the current research. The primary limitation is a function of our analytical approach: since the current analyses are based on correlational data, there is the possibility that unmeasured third variables account for the link between walkability and upward mobility, and thus we cannot make causal claims. Similarly, we cannot conclusively demonstrate chains of causality. In Study 3, for example, though we did not find any evidence for the mediational role of upward social mobility in explaining links between walkability and a sense of belonging, it is possible that both walkability and upward social mobility induce a sense of belonging, and our findings could be driven by this alternative specification. Since we cannot manipulate either walkability or a sense of belonging, we cannot fully disambiguate between these two accounts. In Studies 2 to 4, there is a possibility of selection bias in that people who like to walk chose to live in walkable cities or neighborhoods and vice versa. Study 1 does not have this problem, as children are unlikely to be able to choose where to live in childhood. In Study 1, the city in which the participants grew up, while not randomly assigned, is not an endogenous variable, and the selection bias in Study 1 is not a major concern. Nevertheless, it is important to explore whether there is a causal effect of living in a walkable city in the future.

Secondly, our analyses treat walkability and access to public transportation as interchangeable. While they are strongly correlated, it is likely that each has its own separate impact on upward mobility. For instance, Lachapelle, Frank, Saelens, Sallis, and Conway (2011) found that even within equally walkable neighborhoods, individuals who used public transportation to commute had more moderate-intensity physical activity than those who drove (see also Saelens, Moudon, Kang, Hurvitz, & Zhou, 2014). The availability and use of public transportation thus could have an independent effect on an individual's upward social mobility. As measures of public transit availability become more comprehensive (as of now, there are far more cities with Walkscores than Public Transit scores available at www.walkscore.com), future work disentangling the two factors will be important for guiding policy recommendations.

Thirdly, Studies 3 and 4 relied on self-reported walkability, while other researchers interested in walkability have used more objective GIS-based measures (Todd et al., 2016). As

Studies 3 and 4 find, it is related to self-reported frequency of walking. However, as walkability is a multidimensional construct, ranging from purely physical aspects such as intersection density and connectivity, to the presence of sidewalks, to proximity to restaurants, banks, and other amenities, to recreational opportunities (Forsyth, 2015), and different aspects of walkability may affect different paths to upward social mobility. In addition to the hardscape (built environment) and accessibility of amenities which is captured in the Walkscore measure used in Studies 1 and 2, and which may have a more direct effect on the link between car ownership and employment, the softscape of a neighborhood, such as its green spaces and lighting also affect perceptions of an area's walkability (Hajna, Dasgupta, Halparin, & Ross, 2013) and may have a more direct effect on a sense of belonging. Our current analyses, based as they are on either the hardscape-limited Walkscore or global individual perceptions of walkability, cannot disentangle all these distinct aspects of walkability, and future studies with more focused definitions of walkability, or which manipulate perceptions of walkability even without changing the hardscape will be useful, especially when it comes to policy recommendations.

Fourthly, whereas we found a robust association between walkability and upward social mobility in the city-level analyses of Study 1, we did not observe the direct association in the individual-level analyses of Studies 3 and 4. It may be that walkability is an emergent property most clearly visible at the level of aggregate, not at the level of each individual. This seeming paradox can be illustrated with a reference to epidemiology. Studies, for example, clearly indicate a strong association between air quality and prevalence of lung cancer when examined at the level of city or county (e.g., Hemminki & Pershagen, 1994), yet, when examined at the level of individuals, the association is null or non-significant (e.g., Beelen et al., 2008). This is in part because lung cancer is rare. When examined at the level of city, cancer prevalence could range from 0% to even more than 10% with gradation in each level. When observed at the level of individuals, however, most of them do not have cancer, and therefore the effect of air quality is hard to discern. The effect of air pollution could be observed much more clearly at the level of city or state than individuals. Failure to sample broadly enough, in other words, may obscure larger trends, especially when the outcome of interest (such as lung cancer or moving up the economic ladder) is a somewhat rare phenomenon.

Finally, In an effort to test generalizability, we conducted Study 4 in South Korea. While we assumed that a sense of belonging would be measured more or less equivalently between the U.S. and Korea, this assumption must be tested rigorously in the future using sophisticated techniques such as Item Response Theory (e.g., Reise, Widaman, & Pugh, 1993).

Societal progress is often measured by whether the life of the current generation has gotten better than that of the previous generations, with intergenerational upward economic mobility as a critical indicator of the fairness of a society. We find that the walkability of a city is an important predictor of upward social mobility, and that this might be due in part to the fact that in walkable cities residents can get access to employment without owning a car, and in part due to more walking and a greater sense of belonging, which we show have real-world relationships with individual upward mobility. We find walking effects (but not perceived walkability effects) cross-nationally and cross-culturally, both in the individualistic United States and in more collectivist Korea, implying that the link between walking, sense of belonging, and upward social mobility may be widespread and robust. It is not easy to add sidewalks or make public roads more walkable by adding more intersections and crossings. Adding additional bus lines or putting new train lines is also not cheap (Duany, Plater-Zyberk, & Speck, 2000; Speck, 2012). However, these might be wise societal investments if, as our results suggest, they may help rebuild the fading American dream.

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Table 1

Multilevel analysis predicting one's employment status from car ownership and other individual-level controls, as well as walkability and other city-level control variables

	Unstandardized Coefficient (SE)	t-value	df	p-value
For INTRCPT1,B0				
INTRCPT2,G00	1.428832 (0.014313)	99.825	297	0.000
POP10_ME, G01	-0.000482 (0.000381)	-1.265	297	0.207
WALK_MEA, G02	0.009716 (0.000858)	11.323	297	0.000
UNEMPLOY, G03	-0.054288 (0.005503)	-9.864	297	0.000
MED2010I, G04	0.008440 (0.001634)	5.165	297	0.000
For FEMALE slope, B1				
INTRCPT2, G10	0.079304 (0.003868)	20.503	3664221	0.000
For MARRIED slope, B2				
INTRCPT2, G20	0.574766 (0.004418)	130.089	3664221	0.000
For BLACK slope, B				
INTRCPT2, G30	-0.620181 (0.005222)	-118.752	3664221	0.000
For HISPANIC slope, B4				
INTRCPT2, G40	0.010814 (0.005439)	1.988	3664221	0.047
For EDUCATION slope, B5				
INTRCPT2, G50	0.102306 (0.000498)	205.377	3664221	0.000
For IN SCHOOL slope, B6				
INTRCPT2, G60	-0.300917 (0.005121)	-58.758	3664221	0.000
For AGE slope, B7				
INTRCPT2, G70	0.020626 (0.000198)	104.365	3664221	0.000
For INFANT at Home slope, B8				
INTRCPT2, G80	-0.109492 (0.007150)	-15.314	3664221	0.000
CAR slope, B9				
INTRCPT2, G90	0.806842 (0.010762)	74.971	3664221	0.000
POP10_ME, G91	0.000406 (0.000291)	1.395	3664221	0.163
WALK_MEA, G92	-0.008248 (0.000463)	-17.802	3664221	0.000
UNEMPLOY, G93	-0.028971 (0.004061)	-7.134	3664221	0.000
MED2010I, G94	-0.008017 (0.001098)	-7.303	3664221	0.000

Table 2

Multilevel analysis predicting one's annual wage (log transformed) from car ownership and other individual-level controls, as well as walkability and other city-level control variables

	Unstandardized Coefficient (SE)	t-value	df	p-value
For INTRCPT1, B0				
INTRCPT2, G00	10.097962 (0.006583)	1533.864	297	0.000
POP10_ME, G01	0.000605 (0.000174)	3.469	297	0.001
WALK_MEA, G02	0.004800 (0.000412)	11.651	297	0.000
UNEMPLOY, G03	-0.000220 (0.002595)	-0.085	297	0.933
MED2010I, G04	0.011275 (0.000757)	14.892	297	0.000
For CAR slope, B1				
INTRCPT2, G10	0.209253 (0.004639)	45.104	3161012	0.000
POP10_ME, G11	-0.000710 (0.000119)	-5.988	3161012	0.000
WALK_MEA, G12	-0.003759 (0.000179)	-21.006	3161012	0.000
UNEMPLOY, G13	0.000039 (0.001731)	0.022	3161012	0.982
MED2010I, G14	0.000244 (0.000419)	0.583	3161012	0.560
For FEMALE slope, B2				
INTRCPT2, G20	-0.380611 (0.001040)	-365.820	3161012	0.000
For MARRIED slope, B3				
INTRCPT2, G30	0.255015 (0.001187)	214.865	3161012	0.000
For BLACK slope, B4				
INTRCPT2, G40	-0.114753 (0.001724)	-66.582	3161012	0.000
For HISPANIC slope, B5				
INTRCPT2, G50	-0.065245 (0.001581)	-41.264	3161012	0.000
For EDUCATION slope, B6				
INTRCPT2, G60	0.110821 (0.000162)	684.708	3161012	0.000
For IN SCHOOL slope, B7				
INTRCPT2, G70	-0.693620 (0.001622)	-427.594	3161012	0.000
For AGE slope, B8				
INTRCPT2, G80	0.024229 (0.000053)	456.878	3161012	0.000
For INFANT at Home slope, B9				
INTRCPT2, G90	0.045585 (0.002060)	22.133	3161012	0.000

Table 3

Summary Results of Mediation Analyses in Studies 3 and 4

	Unstandardized Path Coefficients (SE)	P-value
Walkability→Belonging		
Study 3	.1640 (.0281)	< .001
Study 4	.0527 (.0405)	.1931
Belonging → Upward Mobility		
Study 3	.0857 (.0207)	< .001
Study 4	.0804 (.0233)	< .001
Walking→ Belonging		
Study 3	.1825 (.0276)	< .001
Study 4	.2022 (.0361)	< .001
Belonging → Upward Mobility		
Study 3	.0879 (.0207)	< .001
Study 4	.0837 (.0235)	< .001

Table 4. Indirect effect (95% CIs) of walkability and frequency of walking on upward social mobility

	Study 3 (US)	Study 4 (Korea)
Walkability	.0064, 0237	-.0021, .0134
Frequency of walking	.0077, .0263	.0071, .0316