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Community economic hardship predicts urban park qualities

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Abstract

Parks are important hubs of human activity and health, as their use is associated with physical, mental, and social health benefits [1], [2], [3]. Yet park qualities, including the presence of natural features, vary by the socioeconomic status of their surrounding neighborhoods, which could contribute to health inequities [4], [5]. Using ecological momentary assessment (EMA) with 327 participants (N_{obs} = 1471), we conducted pre-registered analyses to examine how neighborhood-level socioeconomic factors (operationalized through an economic hardship index [6] were associated with restorative park qualities (e.g., cleanliness, quiet). As predicted, parks in higher hardship neighborhoods were rated less safe, less coherent, less clean, and less well-maintained. However, unexpectedly, they were also rated as more natural. Given this unexpected finding, we conducted exploratory analyses to examine the use of natural features during visits and found that participants visiting parks in higher-hardship neighborhoods, despite reporting higher perceived naturalness, reported less engagement with natural features in the park (e.g., walking trails). This paradox of a higher presence of natural features but lower engagement with them suggests that neighborhood context may influence how individuals use natural spaces within parks. Taken together, these findings show how neighborhood disadvantage shapes the restorative capacity of urban parks, potentially contributing to environmental health inequity.

Clinical trial registration

Not applicable. This was an observational behavioral study and did not involve assigning participants to a clinical or health-related intervention. Therefore, clinical trial registration was not required.

Introduction

City and neighborhood parks are among the most beloved public spaces due to the wide range of activities and facilities they offer [7], [8]. Parks provide numerous opportunities for individuals to engage in leisure, recreation, community building, and physical activity, thereby enhancing emotional, social, and physical well-being [1], [2], [3]. Some of these benefits stem from the access to natural environments they provide [9]. However, parks are not created with identical features, nor are they maintained at equal levels [10], [11]. Some of these differences may be due to surrounding neighborhood characteristics, such as economic hardship. Since park qualities directly contribute to their ability to enhance wellbeing [12], it is important to understand how local neighborhood socioeconomic contexts shape these qualities.

One of the most beneficial and distinctive aspects of parks (especially in urban environments) is their provision of access to nature. Interaction with natural environments can provide cognitive and affective benefits by reducing stress-related symptoms, including lower heart rate, lower blood pressure, and reduced stress hormone levels [13], [14], [15]. The reasons for these benefits have been explained by several theories, such as the stress reduction theory [16], which posits that engaging with natural stimuli and environments can help reduce stress generated by the busy human world. Because many parks

contain natural features (grass, trees, flowers, wildlife) and/or provide access to lakes, fountains, or other bodies of water (blue space), they offer unique settings that can help reduce stress [17].

Other restorative benefits of time spent in nature are supported by the attention restoration theory (ART), which posits that people experience restoration of cognitive functioning through shifting direct attention away from stressful tasks to the gently fascinating stimuli that capture involuntary attention without being overly taxing [18]. ART also identifies reasons people may experience cognitive boosts from specific features, such as the sense of being away, the novelty and richness of the natural world (extent), and fascination derived from spending time in nature [19]. Additionally, the perceptual fluency account states that nature provides a unique environment that facilitates more fluent processing of visual stimuli, owing to its fractalness (i.e., self-similarity) [20], [21]. These theories explain why parks, a medium for accessing nature, are key to stress reduction and attention restoration, which may not be available in other urban spaces. Given evidence that spending time in nature can have health-boosting effects, experts often recommend a “nature prescription” of spending at least 2 hours per week outdoors or in parks to experience these restorative properties [13], [22], [23], [24].

Importantly, while parks are generally considered “nature” and provide users the opportunity to be among natural elements (e.g., trees, bushes, grass), not all parks have natural features. For example, some urban parks feature playgrounds for children and lack grass or shrubs [17]. This may be due to various circumstances or design choices when accounting for park layout characteristics, including city vs. rural, size (micro, macro, neighborhood), shape, accessibility, and location [10]. Parks can also vary in their construction and use depending on the city or state in which they are located [1], [25], [26]. While it is reasonable and beneficial for parks to offer diverse qualities and amenities, parks that provide access to nature may serve as essential touchstones for connecting people to the natural world, as residents of urban environments have frequently reported that parks are their primary means of accessing nature [27]. Additionally, parks offer other key features that benefit parkgoers across a variety of contexts, particularly regarding perceptions of naturalness. Given that naturalness is positively associated with perceived restoration, it makes sense that parks with fewer dimensions of natural features and greenery may offer less restoration [22]. However, naturalness in parks is only one of many important features that are related to human health and wellbeing.

While access to amenities in parks is important (benches, walking trails, sports courts, etc.), prior work shows that the quality and upkeep of these features also matter for various psychological outcomes [7], [8], [17], [28], [29]. Recent work has shown an association between park care and better affective outcomes when parks are well maintained, perceived as clean, safe, and more natural, and have low noise pollution [12]. One study found that government spending on park maintenance in an area was a key contributor to urban residents' wellbeing [8]. They also found that the strongest predictor of wellbeing was the number of parks in an area; however, their analysis did not examine the effects of individual parks, which may vary in quality and use. When parks are accessible, located closer to where people live, and perceived as well-maintained, there is evidence of greater engagement in physical activity and use, which may also promote mental health [7], [8].

Although park quality is an important component for individuals and communities that access them, these features are not distributed equally [30]. Previous literature indicates that neighborhood-level characteristics impact park access, quantity, and quality, with significant differences observed across demographic groups, including income and race/ethnicity [30], [31], [32], [33]. Examples of this include how more privileged, higher-SES, often White neighborhoods may have better-maintained parks with higher use rates [32], [34], [35]. For this reason, increasing access to parks—including expanding parking opportunities, transient greenways, and park connections—is an essential component of efforts to improve park usability for people across socioeconomic and racial groups [32].

Yet not all research indicates that access is the most important factor in determining whether people visit a park. In fact, some studies find no inequities in access [32], but a more consistent picture emerges when examining disparities in quality [11]. Several studies have shown that park safety and maintenance issues are a particular concern in lower socioeconomic status (SES), predominantly minority neighborhoods [30], [32]. As park quality and safety are essential determinants of use and benefits attained through visits [22], [36], [37], merely having a park nearby may not be enough to rectify greenspace inequities in urban areas.

A majority of the literature assessing park qualities and SES has traditionally relied upon geographical information systems and parks audited by researchers using tools such as the Community Park Audit Tool [5], [34]. While these studies are useful for assessing park qualities from an objective standpoint, they may not reflect actual attitudes or perceptions of the people who live in these areas. Naturalness is often assessed using vegetation indices, tree cover, or other greenspace metrics as proxies for the quality of naturalness and then compared with SES data [38], [39]. A study collected both participants' and standardized measurements of park quality, finding that they can diverge depending on location and demographics, suggesting that both objective and subjective measures are important for assessing park quality and SES [40].

Taken together, the existing literature highlights several key findings. First, while access to parks is important, parks vary considerably in the features that offer psychological benefits or encourage regular use. Second, while disparities in neighborhood greenspace have been documented, research has focused primarily on park access (as indicated by location), park safety and maintenance, and overall tree canopy cover. However, disparities in other important features, such as perceived restorative potential, noise, or relative naturalness, have not been explored. This is largely due to limited data on these more subjective qualities of parks.

The current study addresses this gap by leveraging a large dataset of Chicago parks, which were rated by local residents on a variety of features. These features were subsequently linked to affective responses [12] to verify the importance of each feature for emotional well-being in the parks and the likelihood of future visits. Thus, the goal of the present analysis is to evaluate whether these affect-boosting features of Chicago parks exhibit disparities across community areas by the socioeconomic status of the surrounding neighborhood. While past literature has often examined the interconnections

between SES and minority demographics in green spaces [30], [35], this paper explores the community-level structural conditions that lead to perceptual differences in park development, rather than demographics per se.

Specifically, we aim to test the following pre-registered, confirmatory hypothesis: Communities with greater socioeconomic disadvantage (as measured by an economic hardship index) would have parks with worse ratings of the park attributes examined: cleanliness, maintenance, naturalness, noisiness, preference, air cleanliness, and perceived restoration potential (coherence, extent, sense of being away, fascination).

The results of the original validation work [12] also highlighted the importance of park amenities. Thus, as an additional exploratory analysis, we assessed whether the presence of participant-noted natural (e.g., trees, fields) vs. non-natural amenities (e.g., basketball courts, water fountains) differed by community-level SES. While this aim was not pre-registered, we realized that by focusing only on park qualities rather than the amenities (facilities/activities) reported during visits, we might be missing part of the picture of people's overall experiences of the parks beyond reported qualities. We did not have an *a priori* hypothesis about what this exploratory analysis would show.

Method

Using Ecological Momentary Assessment data collected between May and September of 2022 from The Mapping Chicago Project ("Mapping Chicago Project"; https://osf.io/pjfcd/), we examined the relationship between participants' ratings of park qualities (e.g., maintenance, cleanliness, naturalness, noisiness, air quality, safety, feeling of being away, coherence, extent, fascination, and preference) and how those parks differed by neighborhood characteristics (economic hardship index). We also evaluated participants' responses regarding which natural vs. non-natural features they noted while visiting parks for their activities and facilities.

Participants

Ratings were collected from two groups of participants: Mapping Chicago EMA study participants (N = 303, N_{obs} = 1235) and student research assistants from the University of Chicago and Mapscorps, a Chicago-based community partner (N = 24, N_{obs} = 236). We collected 1235 park ratings from 327 participants. Mapping Chicago study participants were recruited through social media platforms such as Facebook and Craigslist for a 2-week study during the summer of 2022. Eligible participants were selected by meeting the following criteria: (1) 18 years or older, (2) lived in the city of Chicago, (3) did not live in a community that may have already been oversampled from prior waves of data collection. When participants met these criteria, they received instructions for enrolling in and using the ExpiWell platform (https://www.expiwell.com; [12]).

Study Procedure

Participants used the ExpiWell app to collect data by rating their experiences while visiting a variety of parks across Chicago. Participants completed between 3 (minimum) and 5 (maximum) surveys of different parks and were compensated $10 per park survey. GPS data were also collected to verify that people were at the listed park location. The University of Chicago Institutional Review Board reviewed and approved the study protocol. All participants provided informed consent before participating. For a more detailed description of methods, please see the OSF page. For this analysis, we focused solely on the park surveys.

Study Context

Chicago is one of the largest cities in the Midwest, with more than 1.5 million residents. This city is uniquely dense with parks, from neighborhoods to downtown, making Chicago fortunate to have one of the largest park areas per square mile in the US. Despite this richness, not all parks are designed similarly, particularly in terms of size, quality, or use. Additionally, while Chicago parks vary along many axes, one is the way nature is situated in their design and appearance. Chicago, as an urban center, has a variety of parks, some with more built features than natural ones. Millennium Park, one of the most famous parks in the USA, is home to the "Bean," or Cloud Gate sculpture, a popular tourist destination in downtown Chicago. Given the diversity in parks, along with the demographic diversity, Chicago proves an almost unique opportunity to assess the relationship between park features and community wellbeing.

Measures

Economic Hardship Index:

To measure community-level socioeconomic factors, we used the Economic Hardship Index taken from the [6], a geographic-comparison composite comprising factors such as unemployment rates, age dependency, education level, per capita income, housing crowding, and households below the poverty level. This amalgamation was collected using the CDC's 2018 ACS 5-year data (which was the time point available during data collection in Summer 2022) and compiled based on these contextual factors.

Park Quality Perception Variables:

Our park quality variables were taken from participant ratings. *Cleanliness* was assessed by asking "How clean is the park?" on a 7-point Likert scale (1 = very messy, 7 = very clean). *Naturalness* was measured by asking participants to indicate their response on a 7-point Likert scale: "How natural is this park?" (1 = very unnatural, 7 = very natural). *Maintenance* was indicated by answering "How well-maintained is the park?" (1 = very poorly maintained, 7 = very well-maintained). *Perceptions of safety* were measured using two items: whether someone rated their location as safe in the present moment ('safety now') and how they would perceive the area as safe at night ('safe after dark'). *Environmental noise* was measured by asking "How noisy is this area?" (1 = completely quiet, 7 = extremely noisy). We measured *perceived air quality* by asking, "Does the air seem clean/good to breathe?" with response options (1 = yes, 2 = no, 3 =

unsure). Additionally, park goers completed the Perceived Restoration Scale (PRS; [41], which measured agreement with experiencing the following subscales in a given setting; *Being Away* “being here is an escape experience”, *Coherence;* “There is too much going on”, *Extent;* “I can do things I like here”, and *Fascination;* “My attention is drawn to many interesting things”. Each item was rated using a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

Park Activity and Facility Variables for Qualitative Coding:

The following variables were free-response items where each activity or facility participants reported was coded by researchers as either natural or non-natural features: ‘Park Activity’ and ‘Park Facility ', in which participants responded to “What facilities do you use in this park?” and “What activities do you do in this park?”, respectively.

Qualitative Coding Approach

As the benefits of naturalness are well-documented, we also examined the presence and interest in features offered by in-person visits to parks, as well as attention to the natural resources available there. To conduct this analysis, we employed a qualitative coding approach to evaluate self-reported items for each community park. We defined “natural” to encompass park-based facilities or activity-based amenities that parkgoers would likely associate with naturalness (see below for information on validity & reliability). This includes things like grass, trees, lakes, and other blue spaces, as well as how a field, animals, and so on would be considered natural. We sought to determine whether reported neighborhood SES was associated with park-goers' reports of natural features during their visits.

Following familiarization with the data and the 1235 responses from study participants, study staff met to make note of (1) how many items per open response people listed, and (2) how many of these items were natural/nature-based vs. built or indoor features (see Fig. 1 for a more complete list of descriptors). Researchers compiled a list of examples of natural versus non-natural features in parks. Natural/Nature was defined as items that were perceived as originating from nature or as being a part of it. This included items such as grass, trees, and ponds. Non-Natural items included built or otherwise distinguishably man-made features, such as sculptures, pools, sports courts, benches, and field houses. To reduce subjectivity, we were conservative in what we considered nature-based features in parks, wherein features like fishing piers were coded as non-natural.

Researchers then developed a coding scheme to identify how many items participants listed in their responses could be considered natural features in the park, and coded natural features as (1) and non-natural as (0) (see Fig. 2 for further examples). This created two new variables: one for activities and one for facilities. Since participants could list as many amenities for either activities or facility response options as they wanted, the number of items listed ranged from none to more than 15. Given this variety, we captured frequencies for analysis by keeping these variables as integers. Two researchers each

coded the same amenities and facility lists independently, then shared the coded lists with a third researcher, who performed inter-rater reliability analyses while blinded to the coding schemas and the primary goals of the analyses. Inter-rater reliability (IRR) was high and more than sufficient for qualitative coding needs [42]. IRR for Facilities 'total items' was at 89.07%, and Facilities 'nature' was at 86.93%. Activities 'total items' was at 86.15%, and Activities 'nature' was at 86.72%. Discrepancies were highlighted, and researchers then met to resolve any major discrepancies, using the finalized coding for analyses. These variables were then used to evaluate the percentage of listed amenities (Natural items/Total Items Mentioned) that were natural for predicting hardship in the analyses.

Analysis

Confirmatory analyses from our pre-registration (https://doi.org/10.17605/OSF.IO/ZTE2J) focus on correlations between park qualities associated with better affective states in [12] and community-area-level economic hardship, as derived from the Chicago Health Atlas. As stated in the pre-registration, we computed the various indices of average park qualities across all parks within a community area (i.e., average naturalness or maintenance) and correlated them with the community-level hardship index. False discovery rate (FDR) correction was applied to the correlations using the Benjamini-Hochberg procedure, and corrected p-values ('*q*-values') were used for primary statistical inference.

To account for the fact that, in most cases, we had multiple measurements per park and multiple parks per community area, we also ran a set of mixed-effects regressions in which we modeled each park rating by economic hardship, with community area as a random intercept. We also applied FDR correction to each linear regression model, and our primary inference is based on the *q*-values.

For our exploratory analyses, we examined how the new variables were derived from qualitative coding. We then calculated the proportion of "natural" amenities relative to 'non-natural' amenities and examined whether this proportion was predicted by community-level hardship using simple regressions.

All analyses were conducted in RStudio version 4.1.1. Correlations were conducted using the 'Hmisc' package [43], mixed effect regressions were run using the 'lme4' [44] and 'lmerTest' packages [45], visualizations were created using 'ggplot2'[46] and 'ggcorrplot' [47], geospatial data were linked to surveys using the 'sf' package [48], and the 'tidyverse' package [49] was used for data wrangling and cleaning. The datasets generated and analyzed during the current study are available at Zenodo Repository, https://doi.org/10.5281/zenodo.22313173.The code generated during the current study are available at Zenodo, https://doi.org/10.5281/zenodo.22313228

Results

Confirmatory Correlation Analysis

Results of the correlations between community-level economic hardship index and average rated park qualities are shown in **Fig. 3**. After Benjamini-Hochberg FDR correction of p-values ('*q-values*'), significant

negative correlations were found between hardship (HDX) and park maintenance (r = − .36, p = .001, q = .007), park cleanliness (r = − .35, p = .002, q = .007), perceived safety (r = − .35, p = 0.002, q = 0.007), and coherence (r = − .40, p < .001, q = .006). Additionally, before FDR correction, there was a significant positive correlation found between hardship and greater park naturalness (r = .25, p = .035, q = .077).

Figure 3. Bivariate correlations between community-level economic hardship (HDX) and average park ratings.

Ratings reflect averages of all ratings for all parks within the community area. All correlation coefficients included. Correlations not significant after FDR correction are marked with X.

Robustness Check: Mixed-Effects Regressions

As a robustness check, we also ran these same analyses using a mixed-effects regression approach to account for the fact that some communities had more parks sampled and/or more overall ratings. As before, we applied FDR correction to hardship coefficient p-values across the 11 tests. Results were very similar using these regressions, with hardship significantly predicting park maintenance (B = -0.007, p < .001, q = .003), cleanliness (B = -0.005, p = .004, q = .01), safety (B = -0.006, p = .002, q = .008) and coherence (B = -0.006, p < .001, q = .003). In addition, contrary to the original hypotheses, this approach yielded a significant positive association between hardship and naturalness (B = 0.007, p = .005, q = .009), and a negative association between hardship and perceived safety after dark (B = -0.003, p = .004, q = .009). Noisiness showed a negative association as well (B = -0.004, p = .04, q = .064) but did not survive FDR correction.

In sum, across both analytic approaches, evidence converged on an association between greater economic hardship and parks that were less clean, less maintained, less safe, rated lower for coherence, and, unexpectedly, higher in naturalness. Because this relationship is complex and likely geographically linked, we visualized how park naturalness ratings compared with maintenance across the Chicago region (Fig. 4). The maps show that large, frequently visited parks on the south and west sides, such as Washington and Humboldt Parks, were often rated high in naturalness but low in maintenance. This contrasts with similar parks on the north side (i.e., Lincoln Park), which scored high for both maintenance and naturalness.

Exploratory Analyses: Facilities and Activities

The regression predicting the percentage of typically used ‘natural’ vs. ‘non-natural’ facilities noted by participants as a function of community hardship was significant (B = -0.001, p = .015), indicating a negative relationship between the use or availability of ‘natural’ amenities and economic hardship. A negative relationship here suggests that areas with greater economic hardship had parks where participants reported using fewer ‘natural’ amenities than ‘built’ amenities. However, there was no association with facilities, which may be because facilities generally refer to more built features, such as restrooms.

Discussion

This study showed that community-level hardship is associated with key park qualities linked to cognitive and affective restoration. Specifically, community-level hardship was associated with lower levels of cleanliness, maintenance, safety, and coherence, and counterintuitively, higher ratings of naturalness. This pattern is consistent with prior observations that areas with lower socioeconomic status may have parks with lower levels of maintenance, park cleanliness, and safety [5], [34]. Across the USA, parks in lower-SES areas tend to face upkeep challenges, which may, in turn, affect engagement and interest in using these important public spaces [30], [50].

One of the most notable findings of this paper is that a higher hardship index is associated with greater overall naturalness in Chicago parks. Park designs vary across Chicago, including the extent to which naturalness is incorporated (Fig. 4). Previous research shows, however, that not all “natural” park spaces in Chicago are of similar quality (e.g., “natural” can include both intentionally planted mature shade trees and weedy, unmaintained vegetation). Fossa et al., (2023) found that Chicago parks were more natural and typically grassy, with less tree cover in lower-SES areas than in other US cities [51]. Similarly, forest patches in minoritized regions of Chicago have been found to be of lower quality and provide fewer ecosystem services than those near White neighborhoods [52]. In areas with higher hardship indices, perceptions of naturalness may vary with factors such as the perceived usefulness of natural spaces, which can directly shape interactions with nature in parks. If naturalness is perceived as being the product of a lack of infrastructure in neighborhood parks, thus being “wild”, or having fewer features that encourage interaction, naturalness in parks may be indicative of a lack of desired services for local residents.

The association of greater hardship with greater naturalness may partially explain our exploratory qualitative results, as noted by participants during their direct observations of parks. It is interesting that participants visiting parks in areas with greater economic hardship reported using nature-based activities less often. Interpreting this, greater naturalness may be less engaging or offer fewer amenities to park-goers, especially when parks are not maintained or considered safe [53], which may also reduce the number of natural activities participants reported in this study.

Another possible explanation for this association is that individuals from lower SES neighborhoods may have less time to spend in nature [2]. This reduced experience could, in turn, lead participants in this study to rate parks as more natural, even when a park is less natural than other parks. However, if this was the case, we would expect people from low SES neighborhoods to rate all parks as more natural, not just the ones in their own low SES neighborhood. Conversely, we would expect people from high-SES areas to rate naturalness lower, regardless of location. We were unable to test this, as people did not visit the same parks in this study; however, future studies should consider how familiarity/experience with nature impacts perceptions of park naturalness and interacts with socioeconomic status.

It is, however, also interesting that we found no association between the listed natural facilities (as opposed to amenities) and the hardship index. One explanation may be purely semantic: Perhaps people

interpreted our question as asking which facilities they used, rather than which activities they did when visiting the park. Facilities may imply a more built component, whereas activities express actions and features within the park. Additionally, initial motivations for visiting parks are likely related to the intended activities people prefer to engage in, which may differ from the facilities they report when actually at the park. For example, participants in our study could have been motivated to go walking in nature, but end up using the restroom while there and reporting this as what they think of the facility. Regardless, park amenity engagements are shaped by myriad processes, though these findings suggest that what is desirable for park-goers may be partially influenced by socio-economic factors, thereby shaping how nature is accessible, usable, and restorative for them.

Given that parks provide an important means of accessing nature in cityscapes and offer people a wealth of recreational activities and facilities, these results highlight the continued need to understand how different cities integrate and manage natural features in park design. As parks may also provide restorative benefits through nature, caring for these spaces is critical to ensuring that these benefits can be enjoyed by all when spending time in essential public spaces. Taken together, this paper offers insight into the complexity of how naturalness is shaped by wealth-related factors at the neighborhood level and into its relationship to the restorative properties of urban parks in the city of Chicago.

Limitations

Several key methodological considerations should be noted regarding this study's design. These include the fact that our marker for SES (economic hardship) uses an amalgamation rather than individual indices, which may not offer a more nuanced analysis of how individual factors influence park restoration, quality, and perceptions of naturalness. However, a composite measure may be a more accurate way to holistically quantify socioeconomic disadvantage than focusing on income, education, or other common indices. Nevertheless, future research should continue to evaluate how individual- and community-level markers influence engagement with parks and natural spaces. Relatedly, because our analysis focuses on environmental disparities at the community level, this work cannot address whether people visit parks within their community or intentionally leave their area to visit a higher-quality park. However, regardless of whether this is the case, the current work highlights that access to parks ought to extend beyond the mere presence of a nearby park and instead include the presence of a nearby, high-quality park.

Another limitation is that our current analyses focus only on community-level hardship. This may be compounded by other demographic factors such as race and ethnicity, which should also be considered, given the historical patterns of greenspace inequities within the USA. However, given that SES and demographic factors like race and ethnicity are often interrelated in the context of greenspace [54], [55], [56], it made sense for our approach to evaluate the hardship index rather than include additional variables, such as racial demographics, for our analyses. This paper offers insight into one dimension that may affect how naturalness is embedded in parks and maintained. Future papers should also consider how to include demographic factors, such as race and ethnicity, to account for the historical

inequities surrounding green spaces. This is a much more complex process that depends on a variety of contextual factors, and future projects should continue to expand on integrating these perspectives into study design.

In addition to our quantitative analyses, we coded open-ended responses, which create additional complexity and notable limitations. When reviewing responses for facilities and activities, respondents were not always clear about the differences between these two amenities, which affected the quality of some data. For example, when asked which facilities participants used when visiting the park, some respondents listed “walking, swimming, hiking,” and other descriptors that were then listed again in the activities question. These duplicates likely resulted from a lack of understanding of the distinction between facilities and activities when visiting parks, and clearer definitions in the survey design would have reduced this repetition. Additionally, while our qualitative coding analyses remained conservative to avoid perceptions of features that may be “squishy” regarding what is considered natural, it would be useful to validate and explore regional differences in perceptions of naturalness by validating these coding schemas through an online platform.

Future Considerations

An important takeaway from this study is the wisdom that parks should be designed with the communities they serve in mind, as not all public spaces have traditionally incorporated community planning and feedback, leading to disconnects in these spaces [57]. The findings from this study highlight that park planning needs to account for more than the typical access and availability of parks; it also needs to consider the quality and maintenance of park features that affect their use and perception, particularly in park design initiatives [34]. This is especially important for considering how park features, including natural ones, are sculpted, curated, and maintained. Nature can be restorative and enhance mental health, especially when these spaces are aesthetically pleasing [12], [58] and offer stress-reduction benefits [16], [59]. Parks that lack attention and care lose their benefits and can appear dangerous or wild, affecting the overall perception of the park. As green spaces and parks are essential public spaces, public policy and development should consider what is valuable to nearby residents to improve their usefulness, including allocating additional resources to ensure safety and maintenance.

Conclusion

Given that people increasingly spend time indoors, encouraging engagement with and access to nature is becoming an ever more pressing issue. As urban parks remain one of the few ways people can directly experience nature and, by proxy, receive some of the restorative benefits for attention [19] or stress reduction from natural settings, these results highlight an area that needs further attention to bolster urban health. Individuals in areas with greater hardship may benefit even more from the restorative aspects of parks, but have fewer safe, well-maintained natural spaces to access these benefits, thereby making neighborhood parks an underused resource.

In conclusion, neighborhood-level hardship factors should be accounted for when evaluating the quality of park amenities and their potential influence on perceptions of natural features within parks. This work takes the literature a step further by not only evaluating the basic components of park quality but also connecting them to the critical psychological benefits of spending time in nature. Additionally, it may be meaningful to consider how natural features are situated within parks, and to examine preferences for built vs. non-built features at the community and individual levels, to continue improving the value of these spaces for the people who reside near them.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the University of Chicago Institutional Review Board. All research procedures were conducted in accordance with the ethical principles of the Belmont Report and applicable federal regulations for the protection of human research participants. All participants provided informed consent prior to participation.

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Author Contribution

TRF - formal analysis, visualization- figures 1 &2 , writing - original draft, writing- review & editingKES - conceptualization, methodology, investigation, writing- review & editingIMS - formal analysis, writing - review & editingEAJ- conceptualization, investigation, writing - review & editingKAQ- conceptualization, supervision, funding acquisition, writing- review & editingMS- formal analysis, visualization, Figures- figure 4 writing- review & editingMGB-conceptualization, writing- review & editing, supervision, funding acquisitionKLM- conceptualization, methodology, formal analysis, investigation, resources, data curation, writing- original draft, writing- review & editing, visualization figures - 3, supervision, project administration

Data Availability

The datasets generated and analyzed during the current study are available at the Zenodo Repository, https://doi.org/10.5281/zenodo.22313173. The code generated during the current study is available at Zenodo, https://doi.org/10.5281/zenodo.22313228.

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Figures



Figure 1

Word cloud detailing participants' reports on the activities used in the parks for qualitative analyses.



Figure 2

Examples of features that were coded as either Natural or Non-Natural.

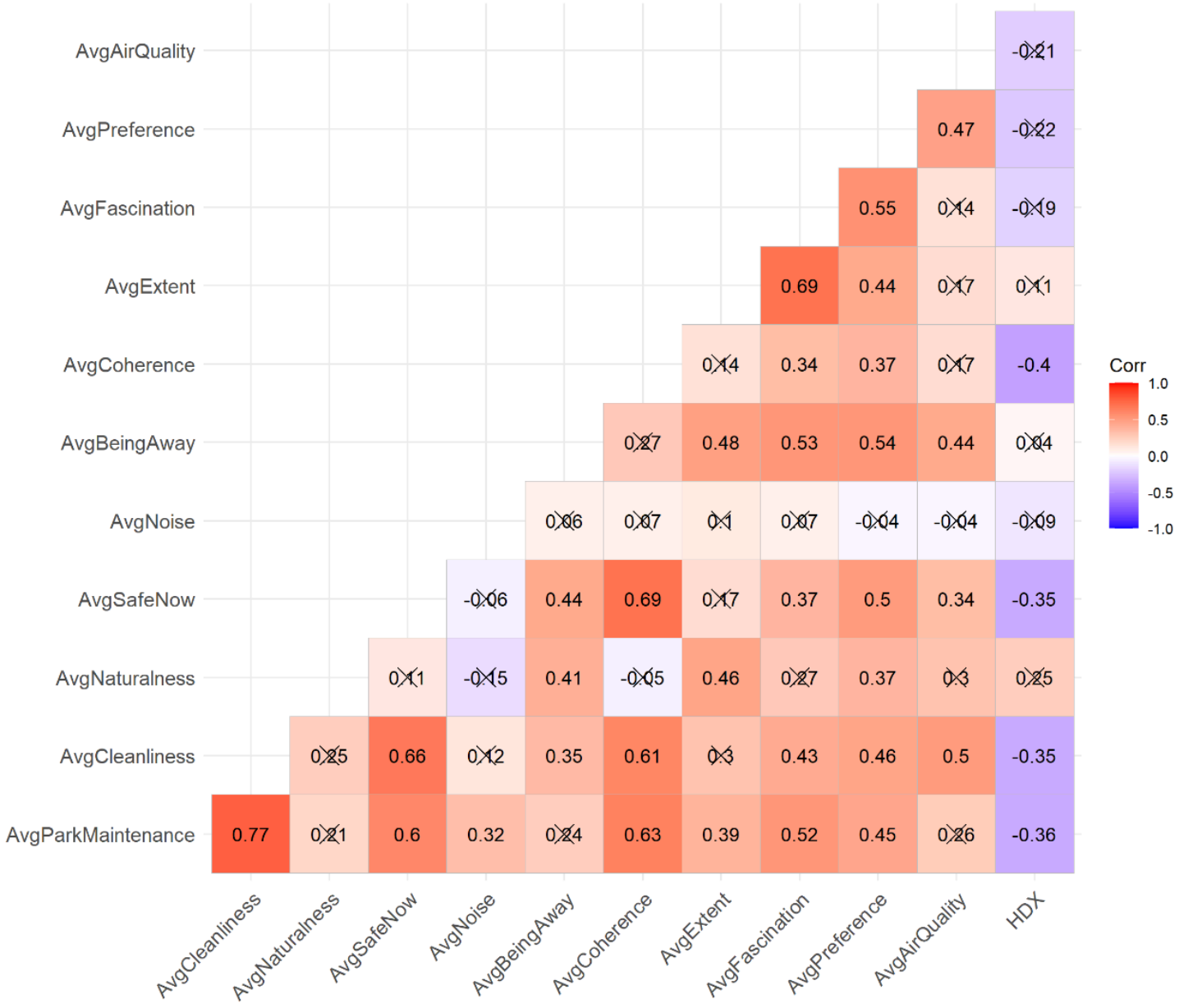


Figure 3

Bivariate correlations between community-level economic hardship (HDX) and average park ratings.

Ratings reflect averages of all ratings for all parks within the community area. All correlation coefficients included. Correlations not significant after FDR correction are marked with X.

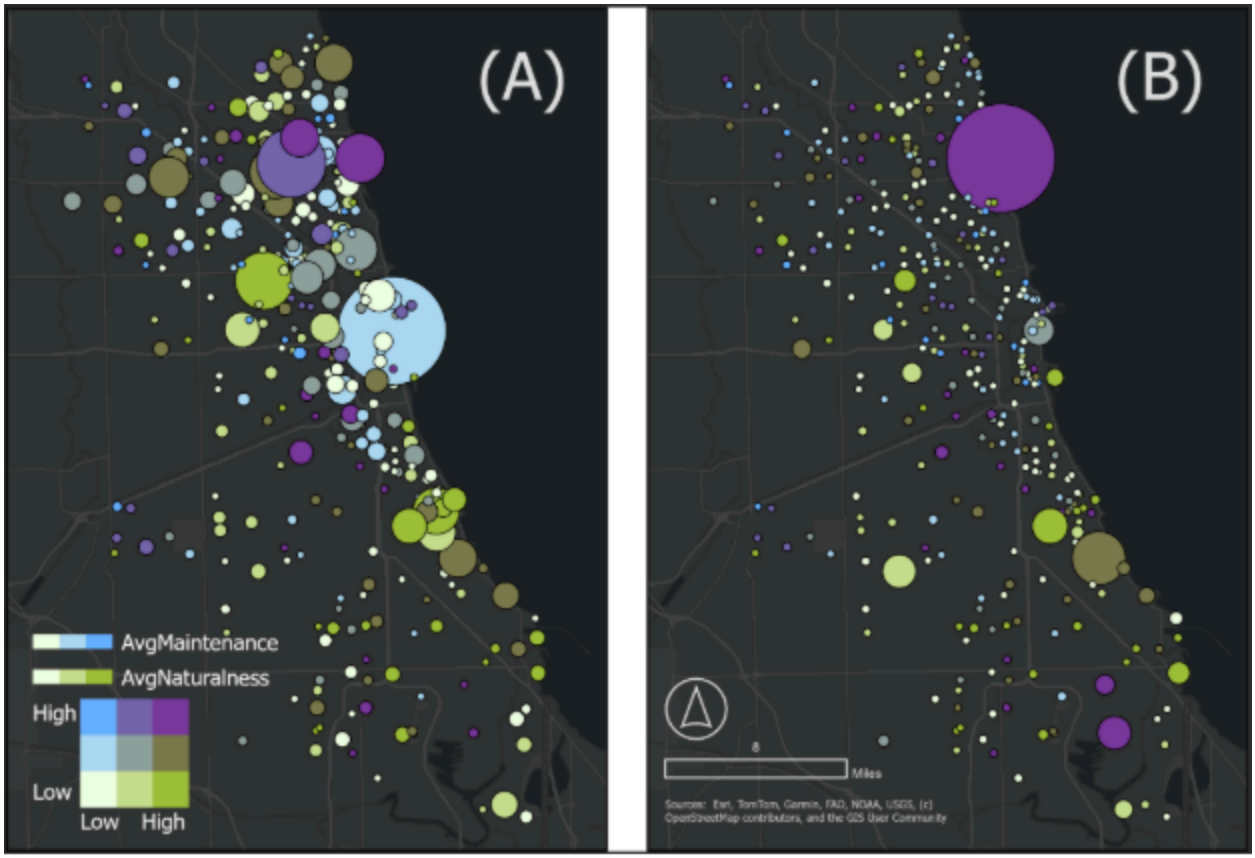


Figure 4

Chicago parks visualized by their combined average ratings of naturalness (white to green) and maintenance (white to blue). For map (A), the size of the dots corresponds to the number of observations, and for map (B), the size of the dot corresponds to the area of the park. Note that not all park observations were able to be matched to an authoritative park boundary, but matching was possible for 93% of observations. This data can be further explored via the web map: https://arcg.is/15Pner9