

THE UNIVERSITY OF CHICAGO

# Nature Breaks Even

CRITIQUE AND REFRAMING OF ATTENTION RESTORATION THEORY

by

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**ABSTRACT**

It is common knowledge that spending time outside in nature tends to improve one's mental wellbeing. Attempting to explain this phenomenon, Attention Restoration Theory proposes that exposure to natural environments refills a certain depleted mental resource. However, research projects attempting to elucidate the psychological workings of this phenomenon have curiously inconsistent results. This paper proposes that this inconsistency can be attributed to the city aesthetic being used as the null condition/status quo against which the natural aesthetic is being tested as a restorative experimental condition. The fault in this arrangement is that the human mind's adaptive relationship with the city aesthetic is not well established, especially in comparison to its stable affinity for natural environments, as posited by the biophilia hypothesis. Humans evolved in and with the help of natural environments, and their recent exodus from these environments into increasingly unnatural urban landscapes has resulted in psychological detriments that are simply alleviated when spending time in nature. This paper discusses the evolution of the urban aesthetic, its biophilic and biophobic elements, and the complicated nature of modern humanity's relationship with the city, all of which render it highly inadvisable for use as a null condition in ART studies.

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### **Nature Breaks Even – Critique and Reframing of Attention Restoration Theory**

Attention Restoration Theory (ART) is a proposed explanation for why exposure to natural environments appears to rejuvenate one's state of mind. It asserts that an individual's voluntary attention has a capacity—it is a finite resource capable of depletion and replenishment (Kaplan & Kaplan 1989). ART's theoretical roots can be traced all the way back to James' proposed separation between attention attracted to interesting features (bottom-up) and executive imposed (top-down) voluntary attention (James 1892). This proposed separation has been backed up by both behavioral and neural experiments (Fan et al. 2005). ART asserts that directed capacity attention is restored by natural environment exposure (Berman et al. 2008). By interacting with “softly fascinating” natural environments, the bottom-up aspect of attention is exercised, giving the top-down alternative a chance to recharge (Kaplan 1995). The term “soft fascination” is used to denote a type of pleasant captivation, in contrast to “hard fascination,” which is somewhat more ostentatious to the senses; Kaplan uses auto racing spectatorship as an example of this (Kaplan 1995).

#### ***Shortcomings of ART***

While ART has ample face validity and reasonable theoretical framework, it has some issues that must be discussed. The behavioral evidence backing up the existence of this phenomenon is not decisive. A systematic review of 31 articles of ART literature showed that exposure to natural environments had positive effects on vigilance, but not top-down attention (Ohly et al. 2016). In this field, “vigilance” refers to sustained attention (Oken et al. 2006). Other uncontrolled factors may mediate the effectiveness of a restorative intervention as well. Age is one such factor. In a 2019 study by Cassarino & colleagues, the researchers found that older individuals showed little to no attentional restoration after environmental exposure, as assessed

by inventories of attentional accuracy, sensitivity to visual targets, and reaction times. This same study showed positive restorative effects in these metrics for younger participants (Cassarino et al. 2019). Beyond the spotty behavioral record of ART research, there are no biological or neurological correlates to the attentional store referred to in ART literature (Neilson et al. 2021). In other words, though one can easily imagine a “tank” in the brain that empties during tedious work and that spending time in relaxing natural environments can refill this tank, as far as we know, this metaphor does not correlate with actual neural activity in the brain.

### ***What Does a “Restorative Intervention” Entail?***

There are also methodological inconsistencies with the restorative interventions used in ART research. To expose participants to nature, a variety of different methods are employed—these methods are referred to as “restorative interventions.” These can involve nature walks, listening to audio of birds chirping, viewing images of gorgeous natural scenery, taking a break



Fig. 1a: An example of an image used in the experimental condition of an ART study.



Fig. 1b: An example of an image used in the control condition of an ART study.

in a space with greenery and plants, all while under supervision by researchers (Craig et al., 2021). These different interventions have mixed results. Much of the inconsistency surrounding the

results of ART research experiments can be attributed to a similar level of inconsistency in how the researchers are exposing participants to nature. Moreover, regarding the above images used in studies such as Berto’s 2005 experiment, I would call the validity of their use into question. No stationary image of beautiful natural scenery or blasé shopping centers like these is capable of fully replicating the sensation of immersion in these environments. Such immersions have been shown to produce consistent restorative effects (Berto 2005); the use of still images

presented in settings divorced from nature itself produce inconsistent results whose use as standards for the genuine landscapes seems inadequate. However, if used simply as ways to imperfectly emulate such landscapes while tapping into the restorative effect to improve performance on cognitive tasks, they are certainly adequate, though direct immersion is more effective at doing so (Craig et al. 2021).

### ***Attempting to Refill a Full Container***

To restore one's attentional capacity, one must first be depleted of said resource. In the context of ART studies, this is typically accomplished by running participants through menial, fatigue-inducing tasks (Berto 2005). This is proceeded by a restorative intervention, then more of the same task as before; performance before and after the intervention are compared. In a 2018 review of ART literature, Joye and colleagues recommended a control condition of unfatigued participants be used in future research (Joye et al. 2018). If exposure to nature during the break results in a performance increase in both attentionally depleted and non-attentionally depleted groups, it would indicate that the nature exposure being used, while effective, is not specifically restoring attentional resources. When assessing performance on a top-down attention task by someone with non-depleted attentional resources, administering an intervention that *refills* those resources should not result in an improvement, as that resource is already at maximum capacity. In a proposed but ultimately unpublished study I was involved with in the Human Factors lab at Texas Tech University under Dr. Martina Klein (Vance et al., 2021), we directly addressed this issue by controlling for the level of attentional depletion while employing the method used by Berto. We found that, regardless of depletion level, performance increased similarly. However, it should be noted that in this study, depletion level was not the only factor that returned null results—the type of images shown (built/natural) did not significantly affect

performance either. In the discussion section, I will discuss a proposed reason for why these null results were found.

### **Current Study**

Over the course of my time at the University of Chicago, I have experienced a paradigm shift in my attitude towards psychological research. While I once sought to remove all “soft scientific thought” from my research, focusing instead on purely neurological explanations for psychological phenomena, I am now more interested in tackling such problems from a multi-disciplinary approach. The idea that being in natural environments is healthier for the human mind than constantly being stuck in the hustle and bustle of city life is so logically sound that it almost seems pointless to spend time and money running studies to empirically prove it to be true. While studying this topic, I often find myself wondering why such a seemingly obvious psychological phenomenon has such shaky empirical backing. It then occurred to me that we might be missing the forest for the trees. Looking at a steel plate at a subatomic level, one may observe the vast emptiness between nuclei and electrons comprising most of an atom’s space and conclude that matter could easily pass through. Only by studying the interactions between subatomic particles and the atom’s interaction with others can you discover the powerful force of electromagnetism binding it all together.

### ***Main Argument***

The urban architectural aesthetic has increasingly alienated itself from nature. Removing oneself from this aesthetic and spending time in nature acts as a return to the evolutionary norm as described by the biophilia hypothesis, yielding the psychological benefits prescribed by ART. The reason why such a seemingly valid theory is so indecisively supported is because the effect



the city has on the human mind is much more unclear, and it is wrong to use exposure to urban environments as a null condition for nature environments to be compared to.

### **Methodology**

I will be exploring this phenomenon from many different academic perspectives, starting with Hegel's discussion on architectural aesthetics and the human spirit. I will show how the evolution of European architectural design from Classical Greek and French Gothic to Italian Renaissance and British Industrial has been accompanied by a steady and marked separation of the people who will use these buildings and their natural environments. I will then explain how the biophilia hypothesis proposes that returning to nature provides positive psychological effects on the human mind, and how this can be used to inform a change in the way buildings are designed. Finally, I will discuss many different aspects of why the human relationship with the city is more variable and nuanced than simply "always harmful," which is why using exposure to urban environments as a control condition in ART studies is wrong and perhaps responsible for much of the shaky empirical backing of the theory.

### **Aesthetics**

Georg Hegel's Aesthetics, or philosophy of art, seeks to understand the nature of beauty. He argues that *being* is understood as self-conscious reason, or *idea*. Regarding nature, this reason is supplemented by *matter*, a physical construct that grounds nature in material reality; it is not entirely an entirely abstract or immaterial concept (Houlgate 2021). Once *life* and *idea* come together, they create *spirit*. Hegel argues that the only place in nature where this conjunction occurs is in *human* existence, that nowhere else in the observed universe is there

*spirit* (Houlgate 2021). Philosophy, the pursuit of understanding the spirit, is the paramount effort of humanity, and religion is one type of philosophy. In Christianity, Hegel says, *idea* is represented by the Holy Spirit—God’s installation of self-conscious reason within humans (Houlgate 2021). Art, on the other hand, is a pursuit that attests to the freedom of spirit within humanity, as it involves weaving objects found in creation into something new and original born from the human mind. To Hegel, this sensuous expression of the freedom of humanity’s spirit is true *beauty*, and the pursuit of maximizing and understanding this beauty is referred to as *aesthetics* (Houlgate 2021).

### ***Ancient Greece***

Hegel viewed ancient Greek sculpture as the purest form of artistic beauty, immortalizing the human spirit of heroes and warriors with freedom in ability and form. These sculptures were placed within temples supported by carefully hewn marble pillars, with walls blocking off smaller interior sections of the temple and playing a lesser role in structural support. Greek architectural design, exemplified by temples with tall stone columns, attempts to meld matter into an abstract, inorganic form created by



Fig. 2: Temple of Concordia, Valley of the Temples, Agrigento, Sicily. c.5th century B.C.E.

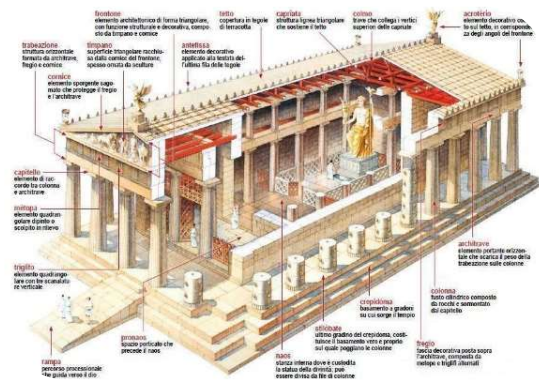


Fig. 3: Diagram of an Ancient Greek Temple.

human understanding, doing so with regularity, symmetry, and harmony (Houlgate 2021). Through architecture, matter is shaped into meaningfully crafted *surroundings* for pursuits that express of the freedom of the human spirit, pursuits such as sculpture and other types of art (Houlgate 2021,

citing Hegel). The key word here is “surround.” As seen in the diagram, the footprint of the area blocked off by walls is significantly smaller than the overall footprint of the structure. Space under the roof and outside the walls allows breeze to pass through the external columns and blur the lines between inside and outside. These temples, albeit aesthetically inorganic, existed as complements to their surrounding landscapes, rather than in juxtaposition to them. Consequently, human activity occurring within these spaces was not divorced from nature. At the foot of a statue of the sky god Zeus, a Greek temple-goer seeking refuge from a harsh storm would *experience* something we 21<sup>st</sup> century folks could never hope to comprehend, an awe of the forces of nature we have long since forgotten. One could argue that this loss of wonder and connection with nature has numbed the indignation we feel when natural environments are exploited for commercial profit (Washington 2019).

### *Gothic Architecture*



Fig. 4: Chartes Cahedral, Chartes, France, c.1194

As western civilization progressed, Gothic design aesthetics rose to the forefront of European architecture. In comparison to Greek temples with roofs supported by pillars without the help of walls, Gothic cathedrals had supporting columns on the inside but featured ornate, highly arched walls separating an inside space from the outside world. These buildings also commonly featured tall steeples pointing towards heaven. To Hegel, the increasingly closed nature of Gothic cathedrals represented the insular sanctuary model of Christian worship. Rather than transforming matter into a form that *surrounds* human activity, architects erected structures to *shelter* Christian inwardness from the outside world (Houlgate 2021). European religion had predominantly become an inward-facing, increasingly moralistic pursuit, and the designs of the

buildings in which religious pursuits took place perfectly reflected this transformation. A faithful French Christian could attend mass to escape any number of happenings in the outside world; the cathedral was a haven provided God Himself. In comparison to our hypothetical Greek fellow both shielded from the storm and fully aware of the might of nature, our hypothetical 13<sup>th</sup>-century Frenchman would not directly *feel* the pressure of the howling winds against his skin, for he was now in the house of the Lord, his prayer to *deliver us from evil* granted by God's providence. Beneath the steeple reaching nearly to heaven itself, he stares up into the lofty rafters of the Gothic cathedral; he is closer to God than ever before. I cannot help but wonder what kind of results a 13<sup>th</sup>-century ART study on populations of many such Frenchmen would yield. Would the untamed, dangerous environment be more restorative than the safety of the built Gothic cathedral? If there truly is some sort of neurological process that restores a human's attentional capacity



Fig. 5: Chartes Cathedral interior.

upon exposure to nature, it would suggest that the unknown wilderness would nonetheless be more restorative. This would not be my hypothesis for such an experiment. There is a certain degree of social construction built up around the restorative effect of nature—or destructive effect of modern built environments. This shift from natural integration to personal isolation in the architectural aesthetics of religious buildings highlights a parallel shift in the role the dominant religion plays in western civilization. What was once how natural phenomena were explained (e.g., the classical pantheons of Greek and Roman gods) evolved into a system of moralizing norms disseminated by religious authorities and received at a personal level by individuals (e.g., Christianity). Religion decreasingly focused on the veneration and preservation of the natural world, giving way to an emphasis on doctrine and introspective examination.

Indubitably, the changing aesthetics of the loci of religious worship accompanied this change; it is reasonable to suggest these changes even contributed to the shift as well.

### *Renaissance Architecture*

Hegel's commentary on the aesthetics of architecture focuses entirely on religious buildings; secular ones were not topics of discussion (Houlgate 2021). However, I would argue that the spirit of humanity, especially that of European Western Civilization, centrally



Fig. 6: Scuola Grande di San Marco, Venice, Italy. c.1490s

revolved around (and was perhaps captive to) the Christian religion from the fall of Rome until the Renaissance, when humanists sought to re-inject aspects of classical antiquity to their long-stagnant societies. This classical revival extended to the architecture of the time as well.

Renaissance architecture sought to emulate certain aspects of Greco-Roman architecture, often adopting the use of neatly chiseled white marble columns for structural support (see image).

However, these renaissance architects were not attempting to directly copy the styles of classical buildings. A 2003 journal article titled “Aesthetic Formalism in Renaissance Architectural Theory” by architectural historian Branko Mitrović asserts that architects of the time were commonly versed in a wide range of scholarly topics, including the Renaissance-era interpretation of Aristotelian cognitive psychology. They held the belief that the human soul was the driving force behind consciousness and sentience; they held the soul in very high regard. In turn, they sought to emulate segments of the human body in the structures they built. Sometimes intentionally and often unintentionally, certain arrangements of columns, rafters, and wooden beams combined to resemble aspects of the human form (Mitrović 2003). Moreover, statues of



Fig. 7: St. Peter's Basilica, Vatican City, c.1506-1626

various saints, religious figures, and royals often adorned Renaissance constructions; the infusion of a building with the human form cannot get any more explicit than that. From churches to palaces, this mantra defined the approach Renaissance architects employed while constructing important

buildings (it is unclear whether they soulfully erected peasants' houses to the same extent). Adopting a classical façade while infusing their works with the humanistic design philosophy of the day, these builders created their own style—they did not perfectly replicate the ways of the ancients. Inspecting Renaissance design under the lens of Hegelian aesthetics as we have done so far, one can see that these buildings are hardly integrated into nature. As with the earlier Gothic architecture, edifices partition off spaces for human activity and wholly shut out the elements. These architects borrow the surface aesthetic of Classical Greek architecture, but they do not (or perhaps cannot) replicate the level of coexistence those classical temples had with their natural surroundings. Moreso than ever before, Renaissance architects were concerned with style over substance—they built structures with minimal concern towards the 'nature' of the materials being used. At this point in European history, humanity has begun to spurn the shelter offered by God; she is getting ready to step outside on her own. She is not afraid of the storm outside, for ways to bend nature to the human will are being developed.

### ***Industrial Revolution***

The tools have been built, and nature will bend. By the time of the Industrial Revolution, the relationship between architecture and the natural landscape is a bit more nebulous, as the brick-and-mortar edifices characteristic of the time were being



Fig. 8: Illustration of Black Country, England, 19th century

built in cities and industrial zones, nearly fully divorced from the wilds. However, if we consider the environmental effects of the functions of these buildings, the unhealthiness of this relationship becomes apparent. Huge smokestacks spew chemicals into the air; sawmills butcher trees to produce fine cuts of wood. Industrial buildings and the activities housed within are not only fully separated from their natural environments, but they are also now actively harming and exploiting them. Consider the cannery, a type of factory dedicated to packaging food into metal cans. In this facility, food adopts an often-cylindrical form factor wholly distinct from how it can be found in nature, for the purpose of preserving it for longer periods of time. This preservation allows for vendors to sell food in commercial settings where the connection between the food, the farmers who grew it, and the place it was grown are wholly ambiguous. The link between canned preserved food and its natural origins has been severed. I argue that the disconnect between human livelihood and nature is responsible for our increasing willingness to destroy the environment for our own gain.

### *Modernity*

If we apply Hegel's line of reasoning towards the aesthetic evaluation of American low-to average-income housing, we recognize that the "freedom of the human spirit" is nowhere to be seen. Cities are erected in the name of efficiency, an efficiency that grows inverse-proportionally to the value assigned to the people who will live there. Rather than acting as elegant



Fig. 9: Common American highway during rush hour.

surroundings for the development of new ideas and the pursuit of greater understanding of truth, buildings act as containers for the cogs that turn the wheels of the economy. This restriction of the human spirit is conditioned into the minds of those for whom urban landscapes represent the

antithesis of freedom. The paradoxically named “freeway” on which a salary worker spends hours per day trapped in commute is called “free” because drivers don’t have to explicitly pay a fee to drive on it, not because they could ever hope to expect a sense of freedom en route. When Edward M. Bassett, the “Father of American Zoning,” coined this term in 1930, he touted the freeway as a place “where concentrated traffic should be freed from disturbances of unnecessary and parasitic uses” such as pedestrian traffic and peddling (Weingroff, 2017). From the dawn of the American highway system, city planning has advocated for the increased freedom to be as efficient as possible whilst restricting the agency of the person who walks around on two feet. To access a macro-level freedom, Americans must confine themselves in rolling metal boxes, move along crowded asphalt paths, enter large concrete rectangular prisms (these might be glass or cylindrical if the person is economically fortunate), work managerially appointed shifts (these might be personally elected if the person is economically fortunate), and do the same thing most days per week, most weeks per year. Hegel’s “freedom of the human spirit” has been worked to death, was efficiently cremated; its ashes compressed into a lavish diamond adorning the finger of a billionaire living the American Dream.

During our trip through the history of European and American architecture, we have observed an evolution of the relationships among the aesthetics of structures, the landscapes outside them, and the attitudes of the people inside. Humanity’s waning connection with the natural environments she has adapted to over hundreds of thousands of years can be attributed to the increasing distance between the architectural aesthetic of the city and that of nature. Long ago, humans adapted to their surroundings to survive—there should be no reason why we cannot do the same to fix this problem as well. If we evolve the way we build our cities, we can adapt to



the psychological threat posed by confined city life, a threat that will not be going away anytime soon unless we act.

### **Biophilia**

The biophilia hypothesis states that humans have a genetic predisposition towards positively responding to nature (Wilson, 1984). Evolving to possess such a genetic predisposition would indicate that this positive response was, at some point in human history, an adaptive trait that increased survival ability or provided a reproductive advantage (Neilson, 2021). A 1993 study by Ulrich observed that many aspects of the prototypical ‘relaxing nature scene’ (open spaces with greenery, flowers, and water) would have provided ways to evade predators and attain sustenance (Ulrich, 1993). When humans interact with nature, their evolved dependency on it activates an adaptive, implicitly positive psychological response.

#### ***Kellert’s Biophilic Design***

If this evolved preference for attributes of nature could be tapped into when constructing buildings, the extent to which humans are separated from nature could be lessened, and the corresponding negative psychological impact could be mitigated. Such is the philosophy behind “biophilic design,” a relatively recent aesthetic and architectural movement aiming to integrate aspects of the natural environment into new buildings being constructed in cities and in renovations to older, industrial-era buildings. Such aspects of the natural environment would have been advantageous for our ancestors to harness, giving them an adaptive advantage over others in the fight for survival. In the paper that formed the foundation for this movement, Kellert (2008) describes color, water, air, sunlight, plants, animals, natural materials, views and vistas, façade greening, geology and landscape, habitats and ecosystems, and fire as the twelve



*Figure 10: "Factory in the Forest," Malaysia. A prime example of biophilic architecture. Image credit: Ho (2017).*

most central environmental features to be incorporated into the external design philosophy of biophilic architecture projects (Kellert 2008). These features correspond to how the building fits into its natural surroundings. Kellert goes on to outline the natural shapes and forms to be included in the finer details of buildings (e.g., arches, columnar supports, geomorphology, etc.), many of which could also be found in the previously discussed ancient Greek temples (Kellert 2008). Central to Kellert's biophilic design philosophy is the idea that buildings should exist within nature; that a person inside a biophilic structure shouldn't feel separated from the outside world. Guided by this mantra, the city's course leading away from the natural world could be reversed. Feelings of being trapped, so common in the lives of those living in modern developed cities, could begin to fade away.

Studies aiming to assess the impact of implementing biophilic design have found promising results. Having access to nature in their workplaces corresponds with higher employee job satisfaction, with the alternative being linked to increased work stress and job-related

negativity. Furthermore, indoor plants and window views of outside greenery corresponded with greater self-reported wellbeing and improved performance on cognitive tasks such as speed-reading (Lottrup et al. 2013, Craig et al. 2022). Though experimental results (as distinguished from survey questionnaire analysis) have yet to be extensively produced in this specific field, what we know so far paints an optimistic picture of what the human-city interface will look like.

### City

The reason for why experimental backing for this phenomenon is lacking lies in the experimental design of the studies attempting to test it. Many ART studies seek to display the statistical significance of the restorative effect of nature by testing natural scenery as the experimental condition against the null condition of city scenery (Berto 2005, Neilson 2021). The rationale behind this is that most humans live in city conditions, therefore those types of environments can be used as a “status quo” against which the novel exposure to nature can be used as a psychological and physiological salve. However, I would argue that natural scenery itself is the evolutionary status quo; rather, the city scenery displayed to and experienced by participants in ART studies is the condition utilizing evolutionarily novel stimuli. Indeed, an adaptive response to cityscapes has not yet developed in humans, as urban environments have not been around nearly long enough for natural selection to decide which attitudes towards the city are most beneficial for survival. As such, there is currently much variability in the attitudes humans have towards cityscapes, a variability that makes them unsuited for use as a control condition against which attitudes towards nature should be tested. In this section, I will explore and discuss factors increasing variability in the human response to urban scenery.

#### *Freedom in proximity*

Despite the seemingly negative impact it has on mental wellbeing, there are numerous benefits associated with city life, advantages that, in some ways, offset its psychological disadvantages. There is a reason why humanity is migrating from rural areas to urban areas. Wealthy individuals often have the capital necessary for living closer to their workplaces, cutting out plenty of time spent trapped in traffic en route. A 2015 study by the National Bureau of Economic Research analyzing geo-coded census data determined that wealthy individuals are increasingly migrating to city centers, away from the suburbs and towards homes they don't have to spend lots of time driving from to get to their workplaces. They hypothesize that this shift is motivated by a desire to increase the amount of free time they get each day (Edlund et al. 2015). They can use this extra time to relax, or, as the paper suggests, work even more hours, earning even more money in the process. They argue that the consequentially greater amount of highly skilled labor being done in in the city center increases the prestige and attractiveness of said city center. Such increases were accompanied by trends such as marked decreases in crime rates between the early 1990s and 2010 (Edlund et al., 2015). This study leaves some questions to be answered, however; do the trends observed in the years leading up to the early 2010s continue now, through the COVID-19 pandemic and the societal upheaval it brought with it? With workers increasingly electing to work from home, will the wealthy continue to move into the prestigious city centers to forego the need for commuting? It should be noted that many jobs held by low- to middle-income workers in retail, restaurants, manufacturing, construction, and the like are not the types of jobs that can be worked remotely like many high-paying white-collar jobs.

The financial benefits of living close to the city center demonstrate that being in an urban environment is not unequivocally detrimental to a person. Does urban sprawl represent a prison whose rations are a stable salary and whose cells are traffic lanes? Is the city center instead a

forward operations base facilitating the accumulation of capital? One could make the argument that socio-economic status and other demographic factors could be correlated with the attitudes one has towards the city aesthetic.

### *The Demographic Line in the Sand*

Rural areas are home to many, if not all, of the types of landscapes that ART research proposes to be restorative. For residents of these areas, it is easier and more affordable for them to take advantage of the psychological benefits of natural exposure than for residents of more urbanized areas. However, it remains unclear whether this translates into a greater tendency to access these environments for restorative treatment. Perhaps the effect of exposure to natural landscapes is weaker in rural populations, as they are more accustomed to living, working, and stressing in these environments, compared to how urban populations interact with nature. This possibility is not yet researched; it would be an important line of future inquiry I propose. In the United States, there are extensive demographic distinctions between rural and urban populations, especially along the lines of race and political ideology. While urban areas are often diverse (to varying degrees), census data has repeatedly shown that rural regions are overwhelmingly populated by white individuals of European descent. While there is nothing inherently sinister about this demographic divide, it raises some significant, under-explored questions about the relationships between rural culture, the phenomenon of psychological restoration resulting from spending time outside, and sociocultural attitudes towards mental health.

Perhaps the lack of conclusive results in the unpublished ART study could be attributed to a unique characteristic of the sample—its rural and urban split. This study was performed on undergraduates from Texas Tech University, an institution in whose student body individuals with rural backgrounds are exceedingly common, more so than most large research institutions

of similar size and caliber. While our demographics questionnaire did not specifically ask participants whether they grew up in rural or urban areas, it is likely that more than a few from our sample came from rural backgrounds; these individuals' psychological responses to the natural landscapes would likely have differed from those of urban-raised participants, possibly introducing a confound.

This begs the question of how capable one's personal experiences regarding natural and built aesthetics are of influencing one's psychological responses to them. If a person has traumatic personal experiences associated with natural scenery, could they lose their biophilic affinity for green environments?

### ***The Cyberpunk Aesthetic***

The cyberpunk genre of media has grown increasingly prevalent in popular culture in recent years. From movies like *Blade Runner* to video games like *Cyberpunk 2077*, the idea of heavily urbanized cities with exorbitant population density, highly advanced technology, staggering income inequality, and corporate hegemony has captured the attention of the popular consciousness. Cyberpunk has been referred to as "anti-humanist" literature (Hollinger 1990), an apt descriptor for a genre in which the individual is fully subservient to the corporation in every aspect of life. In their 2019 doctoral dissertation, Tonći Tošić eloquently described the cyberpunk aesthetic as follows:

"It makes the reader envisage a world in which anything natural is dead and replaced by technology, a world where interpersonal relations are as cold as the neon lighting up the darkness of what the world has become owing to technology as much as to decaying morals of the society" (Tošić 2019).

Numerous cultural influences converged to create an aesthetic that is diametrically opposed to that of the natural environment, influences such as science fiction, futurism, and even gothic

literature (a markedly different topic than the previously discussed gothic architecture) (Tošić 2019).

I bring up a discussion of cyberpunk because of what it stands for and how we respond to it. Cyberpunk represents an evolution of the urban aesthetic; a shared cultural perception of what city life will be like in the future. Our perceptions of what our increasingly urbanized lifestyle will look like in thirty, fifty, a hundred years from now perceptions are often dire, and yet some people are drawn to them, while others are not. This is because the cyberpunk aesthetic (and, by association, the city aesthetic in general) is associated with numerous other social issues: sexuality (Nixon 1992), neoromanticism (Csicsery-Ronay 1988), bodily autonomy (Tošić 2019), and more. All these issues are divisive, and I would hypothesize that the psychological responses people have towards them would be highly variable. There have been no psychological or physiological studies investigating this topic, and I would be excited to pursue these lines of inquiry in the future. Understanding how the brain responds to the aesthetics of its living environment and how these responses are correlated with other variables and individual differences could be greatly helpful in improving the mental wellbeing of many different people across the world.

### **Limitations & Paths Forward**

The big question raised by this paper is whether the restorative effect proposed in Attention Restoration Theory is modulated by one's personal experiences, particularly by one's place of upbringing. Without conducting an experiment accompanied by a demographic questionnaire specifically asking whether the participant grew up in a rural or urban area, the ability to empirically evaluate this question is severely limited. Nobody has pursued this line of

inquiry yet. In the planning stages of this project, I considered using geotagged Facebook data and people's subjective descriptions of their experiences with nature as a metric for its restorative power, but determined that this approach would be too imprecise. It would also involve taking advantage of Facebook's questionably harvested personal user data, an ethically distasteful exploit.

I am also interested in more definitively ascertaining the neurological correlates of the human-city interface. Bermudez et al. (2017) was a novel exploratory study aimed at elucidating built environments' impact on the brain using fMRI and self-report. They found that neural activation in various areas of the brain was markedly different when viewing "ordinary" structures and when viewing extraordinary, contemplation-inducing structures. These contemplative buildings also disrupted the Default Mode Network (Bermudez et al., 2017). Though the neurological specifics of the DMN are much more complex, on the surface level, it can be thought of as "what the brain does when it's not doing anything in particular," an "auto-pilot mode" of sorts (Vance 2021). It overperforms in ADHD populations. It would be fascinating to see how the Default Mode Network responds to natural aesthetics, biophilic architecture, and architectural aesthetics from many different cultures.

Finally, the trip we took through the evolution of European architecture is just that—a trip through Europe. Being an individual of primarily English descent and having taken over a decade of Latin classes and lessons on Greco-Roman culture, I am much more familiar with the history of European civilization than any other, so I elected to focus my research on what I knew best. It is quite the Eurocentric view indeed. It would be fascinating to assess the history of the architectural evolution of Indian architecture, the architectures of the numerous Latin American civilizations decimated by European conquest; there are lots of interesting possibilities. Japan's



Westernization throughout the 20<sup>th</sup> century, the architectural metamorphosis it underwent, and its eventual transformation into the country with both the world's largest metropolitan area and most psychologically taxing workplace culture would be on the top of my list of what to study next.

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