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Urban-Scale Immersive Installations: Light, Sound, and Shared Experience

Introduction

In cities around the world, artists, technologists, and designers have transformed urban spaces into **immersive shared experiences** using light, sound, and interactive media. These large-scale installations – whether artistic, scientific, or commercial – aim to engage the public as active participants. By projection-mapping entire buildings, choreographing vast networks of lights, incorporating soundscapes, or even using biometric inputs like heartbeats and brainwaves, such projects turn plazas, facades, and domes into **responsive canvases**. The goal is often to evoke awe and wonder, to focus a crowd's attention, or to foster a sense of *collective unity* among participants. This report surveys notable precedents from recent innovations and historical analogs, highlighting the technologies used (from high-powered projectors to wearable LEDs and EEG sensors) and the outcomes reported – from social bonding and group "coherence" to new forms of public play and meditation. We also draw parallels to **architectural precedents** – like cathedrals and amphitheaters – that have long been designed to inspire communal awe and focus. The examples are organized by theme and summarized in comparison tables for clarity.

Projection Mapping and Large-Scale Lighting Art

One prominent approach is to use **projection mapping** and synchronized lighting to transform urban architecture after dark. High-lumen projectors can blanket entire facades or domes with dynamic imagery, effectively turning buildings into giant story-screens. Meanwhile, arrays of architectural lights, lasers, or drones create new landmarks of illumination. These installations are often site-specific and can be artistic (e.g. festivals, public art) or commercial (e.g. celebratory shows). Key examples include:

- **Monument Projections and City History:** In Montreal, the ongoing *Cité Mémoire* project (started 2016) scatters over 25 digital projections across Old Montreal at night, animating alleyways and buildings with scenes from the city's past [1] [2]. Viewers stroll from one projection to another, watching historical characters appear "as if coming out of the walls" to tell stories [3]. An accompanying app provides audio narration, but even without it the silent moving images create a contemplative, communal experience – locals and tourists alike pause together, and *"everyone applauds together at the end,"* transcending language barriers [2]. This project, the world's most expansive projection mapping installation, illustrates how cities are using light art to reconnect people with shared history [4]. Similarly, **The Saga** in San Antonio (2014) projects a 24-minute narrative onto the cathedral in Main Plaza nightly, and Egypt's Pyramids have hosted sound-and-light shows since the 1960s – early examples of using monuments as immersive storytelling canvases.

- **Immersive Cathedral Illuminations:** Historic sacred spaces have been reimagined with digital light shows that mix art and architecture. For instance, **Moment Factory's** *Aura* (2017 in Montreal's Notre-Dame Basilica, later brought to Paris and San Francisco) uses **projection mapping, lasers, and a spatialized soundtrack** inside a cathedral to envelop visitors in a 45-minute "IMAX-meets-drone

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show" [5] . The vaulted ceilings and stained-glass arches are bathed in animated color and light, synchronized to organ and choral music [6] . In San Francisco's Grace Cathedral (2025), *Aura* invited the audience to **"send light from your seat to the domes"** via their phones, briefly allowing each person to illuminate the ceiling before the show progressed [7] . Reviews noted that the experience "moves, inspires, and creates a sense of awe," leaving visitors with *"a profound sense of connection – to the cathedral and to one another"* [8] . These multi-sensory installations celebrate innovation and heritage simultaneously, turning architecture into a canvas that brings people together in collective wonder.

- **Artistic Light Festivals:** Many cities host light art festivals (e.g. Vivid Sydney, Amsterdam Light Festival, England's Lumiere) featuring dozens of installations. A striking example is **Daan Roosegaarde's** *Waterlicht* ("water light"), a traveling light sculpture started in 2016. Using blue LEDs and lenses to create wavering sheets of light, *Waterlicht* simulates a **virtual flood** hovering above the ground [9] . At night in Amsterdam's Museumplein, thousands of people gathered under these ethereal blue waves to experience the "dream landscape" of a floodplain without getting wet [10] . The installation is explicitly described as a *"collective experience"* designed to highlight climate change and the need for water innovation [11] . It attracted **60,000 people in one night** in Amsterdam, all standing under the glowing blue "water" and contemplating their relationship with nature [10] . *Waterlicht* has since toured worldwide (Paris, London, Dubai, New York, etc.), leveraging public awe – *"the power and poetry of water"* – to spark conversations about environmental stewardship [12] . Another example, **Dan Acher's** *Borealis*, recreates the aurora borealis with lasers in the night sky, bringing an uncanny natural wonder into city centers and eliciting shared amazement.

- **Cutting-Edge 360° Domes:** Pushing the envelope of projection, the new **Al Wasl Dome** at Expo 2020 Dubai and the **MSG Sphere** in Las Vegas (opened 2023) integrate architecture and AV technology at unprecedented scale. The Al Wasl steel dome (130 meters wide) was built as a **360° projection surface**, hosting nightly immersive shows around an audience in the plaza [13] . Over 250 synchronized projectors turned the dome's interior into a wraparound theater of animated visuals, while an interactive mode even allowed VIP guests to "touch the dome" via tablet and generate real-time graphics and sound across its surface [14] [15] . The MSG Sphere, a giant LED-covered sphere, similarly boasts a **16K wraparound interior screen and immersive audio** to create "awe-inspiring multisensory experiences" for up to 18,000 spectators [16] [17] . Its designers tout it as "VR without headsets," aiming to *"transport the audience out of their regular life"* into fantastical shared worlds [18] . These colossal projects blur the line between architecture and media, promising new levels of **audience engagement and collective immersion** [19] .

Interactive Biofeedback and Synchronization Art

Beyond visual spectacle, many installations involve **direct input from the audience** – measuring peoples' movements, voices, or even biometric signals – to drive the experience. By feeding back data like heartbeats or brainwaves as light or sound, these works make the crowd an integral part of the art. The intent is often to symbolically **sync participants together** or to make an invisible collective state visible. Notable bio-responsive projects include:

- **Pulse and Heartbeat Installations:** Mexican-Canadian artist Rafael Lozano-Hemmer has created a renowned series of **"Pulse"** installations. In *Pulse Park* (2008), he turned New York City's Madison Square Park into a field of **200 spotlights** controlled by visitor's heartbeats. Participants gripped a

sensor that translated their pulse into a flashing light; each new heartbeat sent a pulse of light racing down a row of lamps across the lawn [20] . The result was *"a poetic expression of our vital signs"* in public space – an ever-changing light choreography where **each beam throbbed in time with someone's heart** [20] . Lozano-Hemmer stated his goal was to *"bring everyone together, to allow people to express some sort of agency in a public space"* through this shared biometric experience [20] . Earlier, his indoor **Pulse Room** (2006) similarly invited visitors to hold a sensor; their heartbeat would make one of 100 hanging lightbulbs flicker in rhythm [21] . As more people participated, the pulses of previous participants traveled down the grid of bulbs, so the space literally **filled with the heartbeats of the last 100 people** [21] . These works externalize the intimate, reminding viewers of the collective human presence around them.

- **"Pulse & Bloom" (2014):** At the Burning Man festival, artist **Shilo Shiv Suleman** and collaborators built a garden of 20 giant lotus sculptures wired with **heart-rate sensors**. Placing a hand on a lotus would make it start gently **glowing to the beat of your heart**, and if a second person placed their hand, the lotus would pulsate with *both* heartbeats [22] . The two pulses would gradually synchronize if the people stood together long enough – a phenomenon known as cardiac **bio-synchrony** that the project aimed to reveal [23] [24] . *"When people spend enough time with each other, their heart rates start to sync,"* Suleman notes, and *"we don't usually get to see that"* [23] . **Pulse & Bloom visualized this subtle bonding**: you could literally watch two heartbeat patterns merge into one light pattern, making participants vividly aware of their own and each other's bodies [24] . By inviting strangers to pair up at the sculptures, the installation encouraged moments of connection and calm. It was, in the artist's words, a biofeedback-driven attempt to foster *"collective coherence"* – not unlike the way fireflies sync their flashes or audiences breathing in unison during a shared experience [25] .

- **Collective Brainwave Art:** Some projects tap into **EEG (brainwaves)** to reflect group mental states. **"Mind Over Matter" (2018)** by artist Thijs Biersteker is one example that combines neuroscience with environmental art. In this installation, an audience dons EEG headsets and faces a large digital **sphere**. The visuals on the sphere respond to the **collective brainwave activity**: when the group maintains a *calm, meditative focus*, the sphere's imagery remains balanced and clear, but if **anyone's mind wanders or loses focus, the sphere spins into chaos** – pollution, storms, and turmoil erupt in the projection [26] . In essence, the audience's shared state of mind keeps "the world" in equilibrium, dramatizing how group attention (or inattention) might impact our fragile planet [26] . *"If we keep our focus on the right things, the world does not spin out of control,"* explains Biersteker [27] . This piece not only provided a novel biofeedback spectacle but also aimed to instill a sense of **empowerment and unity**, as participants realized they must cooperate mentally to create a positive outcome [28] . Earlier precedent for brainwave art goes back to the 1970s (artist Nina Sobell's interactive EEG drawings), but new technology has enabled larger-scale implementations like Biersteker's and others that turn group meditative focus into a collective audiovisual event.

- **Biosensors in Entertainment:** Beyond fine art, biofeedback is finding its way into popular experiences. Concerts and cinemas have experimented with measuring audience excitement to influence shows. Coldplay's creative director has noted interest in using **wearable heart-rate trackers** to modulate concert visuals or music in real time [29] . In 2014, Saatchi & Saatchi even prototyped a cinema device that lit up to reflect how engaged viewers were with a film [29] . While these ideas are still emerging, they underscore a trend: *interactive experiences that gauge the crowd's emotional or physiological state* and feed it back into the environment. The implication is that the audience not only witnesses the spectacle but actually steers it collectively – potentially heightening

group awareness ("we all got excited at the same plot twist!") or even encouraging certain desired states (calm, excitement, etc.) as a group.

Wearable and Crowd-Synchronized Technology

Another approach to creating immersive shared moments is distributing **personal devices or wearables** that link each individual into a larger coordinated display. By synchronizing many small lights or screens carried by the crowd, these projects effectively turn the **audience itself into the installation**. This has been popular in music events and large ceremonies, blurring art and commercial entertainment:

- **Coldplay's Xylobands (2012–present):** The rock band Coldplay famously handed out LED wristbands (branded "Xylobands") to every fan at their stadium concerts. These wristbands are wirelessly controlled to light up in sync across tens of thousands of people. During a song like "Yellow," *"they went yellow"* – an entire arena glowing in unison to the music [30] . One journalist described the effect as **"vast rivers of coloured light"** flowing through the crowd, *"like the lighter-wave experience for the age of the e-cig"* [31] . The mass illumination creates a powerful sense of unity and participation: the audience becomes part of the show's canvas. Fans often report feeling deeply moved when they look around and see **everyone's bracelet pulsing together**, connecting the whole stadium in a shared visual rhythm. This technology, first used in Coldplay's 2012 tour, has since spread to other concerts (Taylor Swift, BTS, etc.) and events. It demonstrates how a **simple wearable interface (an LED radio wristband)** can augment social bonding – each person is literally a "pixel" in a gigantic collective display. (Coldplay even tried to recollect and reuse the wristbands at one point to be sustainable, but abandoned that plan due to hygiene concerns [32] , illustrating the logistical quirks of scaling such an interactive system.)

- **Audience Phone Apps:** A DIY variant of the above is to leverage the smartphones people already carry. Electronic musician Dan Deacon pioneered an app that audience members run at his shows; at a cue, everyone raises their phones which flash colors in sync, turning the venue into a coordinated field of screens [33] . While not as perfectly uniform as dedicated wristbands, this approach still generates a thrilling **moment of synchronicity** – and it's two-way, since anyone with the app becomes an active light source. Similarly, organizers of some events have used browser-based tools or SMS to coordinate the crowd (for example, to have everyone's phone display a certain color or message at once). These mass participatory lighting feats are modern high-tech versions of holding up lighters or glowsticks, amplified to an urban scale.

- **Drone Light Shows:** Wearable tech on the ground isn't the only way to involve crowds; sometimes the "pixels" are flying. In recent years, **swarm drone shows** have replaced fireworks in some city celebrations. Hundreds of LED-equipped drones fly in coordinated formations, painting animated patterns or spelling words in the night sky. While the crowd isn't directly controlling the drones, these shows are often designed to be **interactive or contextual** – for example, synchronized to live music or responding to crowd noise. They create a shared focal point as people collectively gaze upward at swirling constellations of lights forming giant 3D images. The social effect can be similar to fireworks (a communal "ooh-ahh" experience), but with the added wonder of high-tech precision and often storytelling elements (e.g. drones forming a dove for peace, etc.). Importantly, drone shows (like those in Olympics ceremonies or New Year's events in global cities) demonstrate society's appetite for **spectacles that everyone can share at once**, and they hint at future possibilities of aerial holography or city-wide AR that could respond to audience input on the fly.

- **Mass Gaming and Interaction:** Some projects turn entire buildings or public spaces into interactive games for passers-by. A classic example is **Blinkenlights (2001)** in Berlin, where hackers converted a skyscraper facade into a low-resolution screen and let the public play Pong on it via their mobile phones. By **inviting anyone to control the lights** on a building in real time, it created a city-scale multiplayer experience and a sense of collective ownership of the urban landscape. In a similar spirit, the **"Crown Fountain" (2004)** in Chicago's Millennium Park features two big LED screens that display faces of Chicago residents; these faces "spit" water out of a fountain nozzle. Children and adults gather to watch and play in the fountain, effectively interacting with the art. While not high-tech interactivity (the videos are pre-recorded), the piece engages the public in a playful, participatory ritual that has become a beloved communal experience in the plaza. These examples show that **interactive public art** doesn't always require biometrics or fancy sensors – sometimes simple elements (light pixels, water) can facilitate social play and connection on an urban stage.

Interactive Sound and Playable Environments

Sound is a powerful medium for synchronization and immersion. Several urban installations function like giant musical instruments or sound-responsive environments, encouraging crowds to create or be enveloped in **co-created soundscapes**. Often these works also incorporate lighting tied to the sound, merging the senses. Such environments can prompt spontaneous cooperation among strangers and a fun form of group bonding through play. Examples include:

- **MASARY Studios' "Sound Sculpture" (2024):** Created by the transdisciplinary artist collective MASARY Studios, *Sound Sculpture* is an **interactive light and audio installation** that invites the public to compose music together in real time. It consists of 25 wireless, location-aware LED blocks laid out in a plaza [34] . Each cube represents a musical note in space; when participants pick up and move the blocks, they change the notes' position in the sequence, thus altering pitch, rhythm, melody and harmony [34] . Essentially, people walking among the glowing cubes are "stepping into a giant sheet of music" – they can rearrange the notes physically and immediately hear the result as the system plays back the composition [35] . The cubes also light up in sync with the sounds, providing visual feedback. Every audience interaction creates a unique musical and light **"score"**, and it takes cooperative play (multiple people moving pieces) to explore the full range of the instrument [34] . At its debut at a winter festival in Providence, *Sound Sculpture* proved to be a **"spontaneous, cooperative composition" experience**, accessible to all ages [36] . Strangers naturally began working together to create pleasing melodies, illustrating how a well-designed interactive environment can foster *creative social interaction* in public space.

- **The Urban Conga's "oPTIK" (2023):** Installed temporarily on Cortlandt Way in Lower Manhattan, *oPTIK* turned an ordinary pedestrian alley into a playful **light-and-sound playground**. The installation featured a series of ten large ring-shaped structures inspired by gyroscopes [37] . Each ring could be **rotated by passersby on multiple axes**, and built-in sensors would respond to the motion by playing musical notes at certain intervals of rotation [38] [39] . By spinning the 6-foot dichroic rings, users essentially "played" the sculpture like a giant collaborative music box, with lights inside the rings glowing and reflecting patterns on the surroundings [39] . The design was open-ended: there was no right or wrong way to interact, inviting *"shared play experiences"* and exploration [40] . According to its creators, The Urban Conga, *oPTIK* was meant to be *"a communal hub for social connection,"* demonstrating how even a temporary installation can spark new social activity in a public realm [41] . People of all backgrounds stopped to play together, take photos, and *"feel a greater*

sense of ownership of the place" as they manipulated the space [42] [43] . This aligns with a broader trend in **"playable city"** design – creating urban fixtures (swings, seesaws, etc.) that reward cooperation with light/sound effects. Another well-known example is the **"Musical Swings"** in Montreal (2011), where a row of swings in a plaza each triggers musical notes; when swung in harmony, they form melodies. Such projects transform city streets into collective play spaces and encourage strangers to synchronize their actions for a delightful outcome.

- **Sound Showers and Acoustic Spaces:** Some public works focus purely on sound to bring people together. For instance, artist Janet Cardiff's renowned **40-Part Motet** isn't outdoors, but in a gallery it places 40 speakers in a circle, each playing an individual choir voice – visitors standing in the circle hear a unified choral piece and often feel an emotional, communal resonance as if *inside* a choir. In urban settings, simpler forms like **speaking tubes, echo domes, or whispering galleries** (e.g. the whispering wall in New York's Grand Central Terminal) demonstrate how architecture can create surprising auditory connections between people, making them interact playfully. Modern interactive sound sculptures (like Yuri Suzuki's outdoor installations of parabolic dishes and tubes) similarly invite people on the street to communicate or make music together, turning passersby into an impromptu ensemble. The key is using *responsive sound* to focus attention and create a moment of shared experience – whether it's cooperative (making music) or simply co-experiencing an unusual sound environment (like a field of speakers or a motion-triggered soundscape that envelops a plaza when people move).

Reported Social Impacts: Coherence, Bonding, and Awe

A common thread in these projects is the intentional pursuit of **social and psychological outcomes** beyond the immediate "wow" factor. Creators often speak of fostering *community, empathy, or collective consciousness*. While measuring such effects scientifically is challenging, anecdotal reports and some preliminary studies suggest these installations can indeed influence group dynamics and feelings:

- **Collective Awe and Unity:** Many large-scale light/sound works aim to evoke *awe*, a emotion known to make individuals feel part of something larger than themselves. In the context of an installation, awe can translate into a sense of unity or togetherness with the crowd. For example, attendees of Moment Factory's cathedral shows (*Aura*) described feeling *"transported"* and deeply moved, sharing an almost spiritual experience with those around them [44] [8] . *Waterlicht* elicited a mix of wonder and vulnerability – people often fell silent under the blue halo, contemplating climate change collectively. Notably, awe has a leveling effect: standing under a towering dome of light or a sky full of lasers, individuals often report a diminished sense of self and an increased sense of common humanity. City officials and sponsors value these events for **bringing diverse audiences together** in a positive, emotional moment. Even if temporary, such moments of communal awe can strengthen social bonds; as one review of *Aura* noted, visitors left with a *"connection to one another"* that wasn't there before [8] .

- **Social Synchrony and "Group Flow":** Installations that require cooperation (like the **musical swings or Sound Sculpture**) can lead to a state of *"group flow"*, where people nonverbally synchronize their actions and fall into a joint creative rhythm. Participants often experience joy and a sense of *bonding with strangers* when they successfully make music or patterns together. The **21 Swings** project in Montreal was even studied by researchers for its social effects – they observed that when the melody emerged (which only happens if swingers coordinate their timing), strangers exchanged smiles and

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interacted more, showing a breakdown of social barriers. Similarly, biofeedback art literally puts people "in sync" physiologically. In Pulse & Bloom, seeing your heartbeat merge with another's light pulse can produce a feeling of intimacy and empathy. The artist reported that couples or friends would often end up **breathing or moving in unison** while interacting with the lotus, almost subconsciously trying to synchronize their heart rhythms. This mirrors real-life phenomena: e.g., a teacher's students unconsciously matching her breathing rate during class [25] . By making such unconscious synchrony visible, the installation likely reinforced it and made participants aware of a shared *"heartbeat of the crowd."* Projects like *Mind Over Matter* go a step further to demand collective mental focus; when successful, they demonstrate that a group of people can consciously achieve a **shared meditative state** – a powerful illustration of group coherence that participants might find inspiring or even spiritual.

· **Empathy and Shared Narrative:** Some immersive environments are designed to cultivate empathy or collective reflection on social issues. For instance, the historic projections in *Cité Mémoire* encourage onlookers from different backgrounds to reflect on the city's history together, perhaps sparking intergenerational or intercultural dialogue as they share memories prompted by the visuals. Roosegaarde's climate-oriented works (like *Waterlicht* or his smog-cleaning tower with public "smog diamonds") often include an element of **collective responsibility** – people come together to witness an issue (rising seas, pollution) and ideally leave with a shared resolve to act. While harder to quantify, organizers often claim these artistic experiences *raise awareness* in ways lectures or signs cannot, by *"moving the heart"* of the public. Even purely entertainment-focused events like drone shows or stadium LED performances can foster **camaraderie** – the feeling of "we all were part of that amazing show" can create social cohesion, if only for the night. Sports psychologists note that synchronized crowd actions (chants, waves, coordinated lights) at games boost the crowd's morale and unity; the same applies in non-sport settings.

· **Attention and Mindfulness:** Interestingly, immersive installations can also serve as antidotes to fragmented attention. In an era of smartphone distraction, these large collective experiences require (and reward) *focused attention*. When a building suddenly lights up with art or a plaza turns into an interactive game, people instinctively put aside other stimuli to be present in the moment. Projects like *In Stillness* by MASARY Studios explicitly play with this: only by holding perfectly still and quiet does the installation "reward" the guest with an enchanting burst of light and sound [45] . In Cambridge, MA, at the Mount Auburn Cemetery, MASARY's **In Stillness** encouraged visitors at a winter solstice event to pause and meditate; if they did, the landscape of a thousand tiny lights around them would **fall dark and silent, "acknowledging" their stillness**, and then any gentle movement would send ripples of light through the trees with accompanying tones [45] . In a hectic urban life, this kind of responsive environment **reinforces mindful behavior** – people ended up collectively standing still for long moments in the dark, a shared quiet reflection rarely seen in a city. When one person finally moved, it triggered a beautiful feedback, essentially saying *"the landscape sees you"*. By focusing attention in this way, the installation created a fleeting community bound by calm awareness. Many attendees described feeling a sense of peace and connection to others in that shared stillness, as if they had jointly participated in a silent ritual.

It's worth noting that claims of increased *"group consciousness"* in such settings are mostly qualitative. However, the popularity of these installations and the public responses suggest that, at minimum, they **draw people together and heighten social awareness**, even if just by providing a common experience to talk about. City planners and cultural programmers see this as valuable for community building. A

neighborhood that collectively engages with an interactive mural or lighting design might develop a stronger sense of identity and pride. In some cases, the process of creating the installation is itself community-building (e.g. residents contribute designs or volunteer as performers). Overall, the intersection of art, technology, and public space in these works provides new tools to *"engineer" moments of social connection* in our cities.

Architectural and Historical Precedents

Long before digital technology, architects and planners sought to design spaces that could evoke awe, focus attention, and bring people together for collective experiences. Many of today's immersive installations echo principles found in **historic public spaces and structures**. Understanding these analogs provides context for why certain motifs (like domes or circular forms) are often chosen for modern immersive projects:

- **Circular Gathering Spaces:** The circle is a timeless form for communal experience. Ancient cultures held rituals in stone circles (e.g. Stonehenge) or around campfires, intuitively recognizing that arranging people in a ring creates equality and unity – everyone can see each other and share a central focus. This concept lives on in modern design: think of **amphitheaters** and **council rotundas**. Classical Greek and Roman amphitheaters were semi-circles of tiered seating oriented to a stage; by curving the audience around the performance, they **immersed everyone in a single focal event** (be it a drama or gladiator spectacle). The architecture also synchronized the crowd's attention and even their reactions (acoustics carried a singer's voice to the last row, ensuring a collective listening). In a way, these were early "immersive shared experiences" – thousands of individuals, unified through architecture, light (torch-lit arenas at night), and sound, reacting in unison to a narrative. Modern sports stadiums, with their 360-degree seating bowls, serve a similar role: they harness human psychology so that **when the crowd erupts in a wave or song, it feels almost like one organism** moving. Many contemporary installations deliberately use circular layouts or invite viewers to stand in the round, tapping into this ancient social geometry.

- **Domes and Skyward Focus:** Domed architecture – from the Pantheon of Rome to Islamic mosques and Renaissance cathedrals – has long been used to inspire awe and a sense of shared spirituality. Under a great dome, people naturally look upward together, often at a brilliantly lit or decorated apex (like the Pantheon's open oculus showing the sky, or a painted Heaven in a basilica). This creates a **collective orientation toward the transcendent**. In a cathedral, the filtered light through rose windows and the soaring height can hush a crowd and synchronize them in silent reverence. Modern domes continue to be built for communal experiences: planetariums and IMAX domes, for instance, enclose audiences under a 360° screen of stars or imagery, eliciting gasps and applause in unison when a dramatic scene unfolds overhead. The new high-tech domes (like MSG Sphere) we discussed marry this architectural power with digital content, but the fundamental impact is similar – a dome gathers people under one "sky" of imagery and sound, symbolically uniting them under that shared firmament. Even the **toroidal** shape (a doughnut-like ring) appears in some contemporary venue designs because it provides an encompassing field around the audience (for example, some 360° theaters and VR arenas use a torus or circular tunnel of screens).

- **Cathedrals and Sacred Spaces:** The architects of Gothic cathedrals in the Middle Ages explicitly aimed to create an overwhelming group experience. The grand naves could hold thousands, all **facing the same direction** (toward the altar and the light of the east rose window). Stained glass

windows turned daylight into a kaleidoscope of colors that bathed the congregation, achieving a kind of **ambient storytelling and mood-setting** much like today's projection mapping does [46]. The height and scale were intended to make individual worshippers feel small yet part of a vast, meaningful whole – much as immersive art can make one feel both lost in the experience and bonded with fellow viewers. It's no coincidence that some modern light artists choose churches for installations (e.g. MASARY Studios' multimedia performance at Grace Church, Providence, 2023): these spaces were the "high-tech" multi-sensory environments of their time – combining **architecture, music (organ, choir), ritual choreography, art (sculpture, painting)** and even incense (scent as a sensory element) to affect congregants. They set the template for designing for *awe and reverence* on a communal scale. Today's secular installations often strive for a similar emotional intensity, if not tied to religion then to art or nature, as a way to glue audiences together in shared humanism.

- **Communal Chambers and Council Circles:** Throughout history, various cultures have built circular or concentrically arranged chambers to encourage unity and focused attention. The **UN General Assembly Hall** in New York, for example, is a modern political amphitheater in the round, designed so that delegates from around the world face each other under one roof – an architectural assertion of collective dialogue (though technology like simultaneous translation is what truly enables the shared experience there). **Frank Lloyd Wright's "Unity Temple"** (1908) for the Unitarian Church is another interesting precedent: it features a cubic space with seating on three sides around a central pulpit, under a large skylight. Worshippers could see one another and the speaker, reinforcing the idea of a unified congregation (hence the name). The building broke from traditional church layouts to emphasize *community* over hierarchy. In indigenous architecture, circular forms like the **Navajo hogan** or tribal council circles similarly provided spaces where participants sit facing inward in equality – a physical layout conducive to consensus and shared identity.

In summary, many design motifs now used in high-tech installations – rings of light, domes of projection, immersive audio – have deep roots in how humans have long **shaped space to shape group experience**. What technology adds is dynamism and responsiveness: today's "digital campfires" can change color, move, or react to us in real time. But the fundamental aim is unchanged: to gather people, engage their senses synchronously, and hopefully ignite some sense of **collective presence or purpose**. The table below compares a selection of past and present projects, illustrating how various technologies and designs are applied to achieve these goals in artistic, scientific, and commercial contexts.

Comparison of Selected Immersive Projects and Their Features

Project (Year)	Technology & Interaction	Location / Scale	Reported Outcome / Impact	Type / Context
Pulse Park (2008, Lozano-Hemmer) [20]	Heart-rate sensors trigger **pulsing beams** of light; each new participant's heartbeat sends light racing through 200 spotlights [20] .	Madison Sq Park, NYC (outdoor oval lawn ~50m)	*"Fleeting architecture of light"* visualizing crowd's vital signs; aimed to **"bring everyone together"** in a public space [20] . People saw their heartbeats join a collective display, fostering unity.	Art – Interactive light sculpture in a public park
Pulse & Bloom (2014, Suleman et al.) [47]	**Touch sensors + LEDs** on 20 giant lotus sculptures; 1 person's touch makes a lotus glow to their heartbeat, 2 people's touch shows **two heartbeats syncing** in real-time [24] .	Burning Man Festival, Black Rock Desert (20 sculptures over large plaza)	Exposed the phenomenon of **heart-rate synchronization** – participants became aware of their own and others' pulses merging [23] [24] . Created intimate connections and group calm as people paired up to see hearts align.	Art/Science – Biofeedback installation at festival
Mind over Matter (2018, Biersteker) [26]	EEG brainwave headsets linked to a **digital sphere** projection; **collective meditative focus** keeps the sphere/world image in balance, while any loss of focus causes chaotic visuals [26] .	Amsterdam (exhibition installation; spherical screen display)	Demonstrated **group consciousness**: when the audience maintained a calm mind together, the art stayed harmonious, but one distracted mind visibly "derailed" the whole – a metaphor for collective responsibility [26] . Gave participants a visceral sense of shared mental focus.	Art/Experiment – Gallery installation for awareness

Project (Year)	Technology & Interaction	Location / Scale	Reported Outcome / Impact	Type / Context
MASARY "Sound Sculpture" (2024) [34]	25 wireless LED-lit **blocks as a MIDI controller**; public can pick up/move blocks to change musical notes and light patterns in real time [34] . **Spatial interaction** creates melodies (like walking through sheet music) [35] .	Providence, RI (downtown plaza; ~20m area "instrument")	Enabled **"spontaneous, cooperative composition"** – strangers co-created music and visuals on the fly [36] . Fostered playful collaboration and social interaction, as each person's action immediately affected the group's sound/light experience.	Art – Public interactive music/light installation
oPTIK (2023, The Urban Conga) [37] [41]	**Gyroscope-like rings** with internal lights and sensors; users spin the 6-ft rings on multiple axes to trigger musical notes every 15° and refract lights [38] [39] . Multi-user open play.	New York City (Cortlandt Way alley; 10 ring units, also toured to Chicago, Montreal, etc.)	Created an *"ever-changing playful atmosphere"* and became a **"communal hub for social connection"** [41] . Shared play was encouraged as people experimented together, feeling a sense of ownership and joy in transforming the space through movement and sound [40] [43] .	Design – Urban play installation (public art/play)
Waterlicht (2016–, Roosegaarde) [11] [10]	High-power blue **LEDs and lenses** project moving waves of light above public space, simulating a **virtual flood** at varying heights [9] . No direct interaction, but atmospheric immersion.	Global tour (e.g. 4-acre Museumplein, Amsterdam; also Paris, London, Dubai, NYC)	Induced **collective awe and reflection** on climate change. Described as a *"collective experience"* on water's power [11] , it drew up to **60,000 people in one night** who stood together under glowing "water" [10] . Sparked public dialogue on rising seas, using shared wonder to inspire shared responsibility.	Art/Public Awareness – Large-scale light environment

Project (Year)	Technology & Interaction	Location / Scale	Reported Outcome / Impact	Type / Context
Coldplay Xylobands (2012–present) [31]	**LED wristbands** given to tens of thousands of concertgoers; radio-controlled to flash in sync with music (different colors/ patterns per song) [31]. Audience as a synchronized display.	Stadiums worldwide (e.g. 50,000 wristbands at Glastonbury Festival)	Transformed audiences into part of the show, creating *"vast rivers of colored light"* sweeping across crowds [31]. Heightened **audience engagement and unity** – fans report feeling "we are all in this together" as everyone literally lights up as one. A commercial entertainment tool that adds emotional impact and collective identity to live events.	Commercial Entertainment – Crowd LED synchronization

Table: Comparison of various urban-scale immersive installations, highlighting their interactive technologies, contexts, and social impact claims. From bio-data-driven art to playful public instruments and massive light shows, each exemplifies a way that light/sound technology can transform a group of people into a *cohesive, participatory audience*. (Sources: see citations in text above.)

Conclusion

Spanning art, science, and spectacle, these precedents show how immersive installations at urban scale can create **moments of shared magic** in the public realm. Whether by bathing a plaza in interactive light, turning architecture into living murals, or synchronizing thousands of heartbeats and hand-held lights, they tap into a fundamental human desire to **be part of something larger**. Technologically, the examples range from high-end projection mapping systems and sensor networks to simple wearables and mechanical play objects – underscoring that *immersion is not one size fits all*. A small interactive sculpture in a park might engender as much communal joy as a high-budget 360° dome show, if it is thoughtfully designed.

What they all share is a blending of the **physical and the virtual, the individual and the collective**. The city itself becomes a canvas and a playground, and citizens become co-creators of the experience. The reported outcomes – increased social bonding, collective mindfulness, awe, empathy – suggest that these interventions can momentarily counteract the isolation and fragmentation of modern urban life. They invite people to look up from their private screens and **experience something together**, be it a song, a story, a game, or a glowing nightscape that responds to their presence. In doing so, these projects carry forward a lineage of immersive communal spaces that stretches from ancient amphitheaters and cathedrals (where architecture unified audiences) to today's media-rich environments (where technology does the same, in new and surprising ways).

As cities continue to seek engaging public experiences, we can expect even more integration of **biofeedback, responsive lighting, AR/VR, and participatory design** in urban installations. From

holographic illusions on skyscrapers to interactive art domes that measure group "vibes," the possibilities are vast. The examples in this report illustrate not only what has been achieved so far, but also serve as inspiration for future innovations that could scale up the concept of **the city as a shared immersive canvas**. Each project – real or conceptual – offers lessons on technology, scalability, and human psychology, helping designers craft the next generation of experiences that might bring crowds into sync in the heart of our cities.

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