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Temporal continuity and cultural preservation:
Philosophical frameworks for digital heritage
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Abstract

The digitization of cultural heritage through virtual reality, augmented reality, and three-dimensional reconstruction technologies has transformed how societies preserve, access, and experience architectural legacies. Yet, theoretical frameworks for understanding the temporal, experiential, and participatory dimensions of digital heritage remain underexplored. Early 20th-century philosophical aesthetics, particularly concerning time, perception, and cultural expression, offer valuable insights for contemporary digital preservation practices that have rarely been applied to this domain. This article examines how Henri Bergson's concept of *durée* and Bernard Bosanquet's theory of aesthetic experience provide analytical frameworks for digital cultural heritage engagement, and investigates how early cinematic innovations in *The Golem* (1920) and *Metropolis* (1927) prefigured contemporary concerns about technological mediation of cultural memory and architectural representation. Employing philosophical hermeneutics and comparative cultural analysis, this research applies Bergson's *Introduction to Metaphysics* (1913) and Bosanquet's *Three Lectures on Aesthetics* (1915) to contemporary digital heritage case studies and immersive heritage platforms. The research illuminates how digital platforms collapse temporal boundaries, enabling simultaneous experience of past architectural states and present reconstructions, and how individual subjective experience and universal cultural themes explain participatory preservation practices. On the other hand, early cinema's spatial construction techniques directly parallel contemporary virtual reality/augmented reality methods for creating immersive cultural environments. These early modernist frameworks remain critically relevant to digital heritage practice, providing conceptual foundations for temporal fluidity in virtual environments, participatory preservation models, and ethical considerations in digitally mediating cultural memory.

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1. Introduction

The preservation of cultural heritage has always been an act of resistance against time. Civilizations have carved memory into stone, painted it onto walls, encoded it into narratives and rituals. Each medium represents a different negotiation between the permanence of meaning and the transience of material form. The emergence of digital

technologies at the close of the 20th-century introduced a new and radical set of tools into this negotiation: three-dimensional (3D) laser scanning, photogrammetry, virtual reality (VR), augmented reality (AR), and computer-aided design now allow heritage sites to be captured, reconstructed, and experienced with a fidelity and accessibility impossible in any prior era.

Yet, the rapid proliferation of these tools has outpaced the theoretical frameworks through which practitioners and scholars understand them. Digital heritage platforms are frequently evaluated through the lens of technical accuracy—the millimetric precision of a light detection and ranging (LiDAR) scan, the polygon count of a 3D model—without adequate attention to the experiential, temporal, and participatory dimensions that determine whether these digital environments genuinely communicate cultural meaning. The question of how users experience time within the virtual environments, or why individual acts of documentation aggregate into collective cultural memory, remains philosophically undertheorized.

This paper argues that early 20th-century philosophical aesthetics, specifically Henri Bergson's concept of *durée* (duration)¹ and Bernard Bosanquet's theory of aesthetic experience², provides precisely the conceptual vocabulary needed to address these questions. These theorists were working at the same historical moment as the Weimar-era filmmakers who first confronted the challenge of using technology to create immersive, emotionally resonant representations of built environments. The elaborate architectural sets of Paul Wegener's *The Golem* (1920)³ and Fritz Lang's *Metropolis* (1927)⁴ were not technical achievements as much as attempts to collapse temporal and spatial boundaries through technological means, creating environments in which viewers could experience multiple layers of cultural memory simultaneously. In this sense, they were not only the earliest examples of mass-audience immersive heritage experience, but they were among the earliest artistic responses to the same philosophical problems that digital heritage practitioners face today.

The argument proceeds in three stages. First, the theoretical frameworks of Bergson and Bosanquet are examined on their own terms, identifying their core concepts and their relevance to questions of temporal experience and aesthetic participation. Second, these frameworks are applied to the cinematic work of Wegener and Lang, demonstrating how the specific architectural and narrative innovations of Weimar cinema enacted Bergsonian and Bosanquetian principles before they were named as such. Third, and most substantively, both the philosophical frameworks and the cinematic precedents are applied to contemporary digital heritage practice,

through case studies in 3D documentation, virtual reconstruction, crowdsourced preservation, and immersive VR/AR environments. Throughout, the emphasis is not on technology for its own sake, but on the philosophical question of how people relate to cultural memory across time and how digital tools either enable or foreclose the richest forms of that relation.

It should be acknowledged at the outset that the discussion of historical perception, temporal experience, and cultural memory is a considerably broader and more transdisciplinary field than the frameworks examined here can fully encompass. Scholarship on art in public space, interactive museum design, the phenomenology of place, and the epistemic contributions of fictional history has long engaged with questions of how layered pasts are experienced, how memory is continuously reworked, and what role imagination plays in that process. The present paper does not propose to survey this terrain. Rather, it makes a focused philosophical argument: that Bergson's *durée* and Bosanquet's aesthetic dialectic constitute a productive and underutilized conceptual vocabulary specifically for the temporal and participatory dimensions of digital heritage platforms—dimensions that the broader literature on historical perception has not addressed with the same analytical precision in the context of immersive digital environments.

The article employs philosophical hermeneutics and comparative cultural analysis as its principal methodological approaches. The hermeneutic procedure involves iterative close reading of the selected primary philosophical texts—Bergson's *Introduction to Metaphysics* (1913) and Bosanquet's *Three Lectures on Aesthetics* (1915)—to identify their operative concepts, and then a sustained interpretive application of those concepts to the selected cinematic and heritage cases. This is not a linear process of deductive application but a circular one, in which the heritage and cinematic material in turn illuminate and refine the philosophical concepts, following the logic of the hermeneutic circle. The comparative analysis places structurally analogous phenomena from two distinct historical and technological contexts—Weimar-era cinematic technique and contemporary digital heritage practice—in systematic relation, examining shared underlying principles rather than superficial technical similarities. Case selection followed explicit criteria: the philosophical frameworks (Bergson and Bosanquet) were selected as contemporaries of the first technological mediation of mass cultural memory (cinema), whose work directly engaged the experiential and participatory problems that digital heritage now confronts. The cinematic cases (*The Golem*, *Metropolis*) were selected as the two

most architecturally ambitious Weimar productions with fully documented design processes. The five contemporary heritage cases (CyArk Petra; Notre-Dame LiDAR; Palmyra and #NewPalmyra; Google Arts & Culture Open Heritage; Smithsonian Skin and Bones AR) were selected to represent the three analytical dimensions identified by the framework: temporal fluidity, participatory preservation, and immersive embodied engagement. The principal limitation of this approach is that it is conceptual rather than empirical: the cases are analyzed as philosophically illustrative instances, not as subjects of user research or quantitative evaluation. The claims made here concern structural and theoretical correspondences, not measurable experiential outcomes.

2. Theoretical framework: Bergson, Bosanquet, and the aesthetics of temporal experience

2.1. Bergson's *durée*: Time as continuous flow

Henri Bergson's *Introduction to Metaphysics* (1913)¹ presents one of the most consequential critiques of how Western philosophy and science have traditionally conceived of time. Bergson distinguishes between two fundamentally different modes of knowing reality: the analytical, spatialized mode that dominates scientific and philosophical discourse, and the intuitive, durational mode that he regards as closer to the actual nature of experience.

The spatialized conception of time, as Bergson argues, treats time as analogous to space, a linear sequence of discrete, measurable moments that can be laid out side by side, counted, and analyzed. This model is adequate for scientific purposes as it enables calculation, measurement, and prediction, but it fundamentally misrepresents the lived experience of time. When we actually experience duration, the past, present, and future do not exist as separate compartments; they interpenetrate. The present moment carries the accumulated weight of all past moments, and our anticipation of the future colors our experience of the now. Bergson describes this interpenetration through the concept of duration, a continuous, indivisible flow in which temporal moments do not succeed one another but rather coexist in a qualitative multiplicity.¹

This distinction has immediate implications for how we understand cultural heritage. If time is, at the level of lived experience, not a sequence of discrete historical moments but a flowing continuum in which multiple temporal layers coexist, then the ideal heritage experience does not present the past as a fixed, archived object but one that enables the visitor to inhabit a temporal flow in which multiple historical states of a site exist simultaneously. The ruin and

the reconstruction, the ancient original and its modern documentation, the physical artifact and its digital twin, are not opposites but aspects of a single durational reality.

The concept of intuition is equally important here. Bergson argues that analytical knowledge always works by decomposition, breaking a phenomenon into elements, studying each separately, and attempting to reconstruct the whole from its parts.¹ But this process necessarily misses the essential character of any phenomenon that exists as a continuous flow rather than a collection of discrete components. Intuition, by contrast, is a direct, sympathetic engagement with the object as it is, without decomposition, without translation into abstract concepts. This mode of knowing is not irrational, and it is, for Bergson, more adequate to the actual texture of reality than rational analysis. For digital heritage practitioners, this suggests that the richest forms of cultural sites are those that enable intuitive, embodied, continuous engagement with the site as a living temporal entity.¹

2.2. Bosanquet's aesthetics: Individual expression and universal meaning

Bosanquet's *Three Lectures on Aesthetics* (1915)² develops a theory of aesthetic experience grounded in the dialectical relationship between the individual and the universal. For Bosanquet, the defining characteristic of genuine aesthetic experience is its capacity to hold these two dimensions in productive tension. Every significant artwork embodies, simultaneously, the unique subjective perspective of its creator, the particular choices of form, emphasis, and expression that reflect a specific individual sensibility, and a universal dimension that resonates across the boundaries of individual experience and speaks to shared human concerns.

This dialectic has direct implications for understanding cultural heritage. Any significant heritage site is both particular and universal. It embodies the specific creative decisions of particular architects, builders, and patrons operating in a specific historical and cultural context, and it also carries meanings that extend beyond that context to speak to broader human experiences of beauty, power, community, and time. The challenge for heritage preservation is to honor both dimensions: the particularity of the original context, which demands historical accuracy in documentation, and the universality of the cultural meaning, which demands accessibility, interpretation, and experiential richness.

Bosanquet's framework is especially relevant when applied to participatory heritage practices. When communities contribute their own experiences, memories, and documentation of heritage sites, they engage

in the dialectical process that Bosanquet describes. Their individual, subjective acts of documentation (a photograph, a resident's oral history, a scholar's survey) are simultaneously expressions of personal experience and contributions to a collective, universal cultural archive. The digital aggregation of individual contributions into comprehensive heritage resources is not simply a technical process but an aesthetic one: the synthesis of subjective particularity into universal cultural significance.²

2.3. Convergence and complementarity

Bergson and Bosanquet were contemporaries working within the broadly idealist tradition of early 20th-century European philosophy, and their frameworks converge in important ways.^{1,2} Both reject reducing aesthetic experience to purely objective, quantifiable properties. For Bergson, intuitive temporal flow cannot be captured by analytical measurement, and for Bosanquet, aesthetic value cannot be reduced to formal features independent of subjective experience.^{1,2} Both recognize the social and cultural dimensions of individual experience. The individual's experience of duration is always already shaped by collective cultural frameworks, just as individual aesthetic expression is always already in dialogue with universal human concerns.

Together, these frameworks provide a two-dimensional conceptual lens for digital heritage. The temporal dimension is how digital platforms enable the coexistence of multiple historical states of a site within a single experiential moment, and the participatory dimension is how individual acts of documentation and engagement contribute to collective cultural preservation. These two dimensions correspond precisely to the two defining features of contemporary digital heritage practice: its capacity to represent temporal complexity, and its embrace of participatory, crowdsourced models of preservation and access.

3. Weimar cinema as proto-digital heritage

3.1. The architectural vision of *The Golem* (1920): Hans Poelzig and the expressionist city

Paul Wegener's *The Golem: How He Came into the World* (1920) is a landmark in the history of cinematic architecture. The film's visual world was created by Hans Poelzig, one of the most significant architects of the German expressionist movement⁵, who designed the sets as active participants in the film's cultural argument. Poelzig's conception of the medieval Prague Jewish ghetto is immediately recognizable as an architectural expression of a philosophical position. The buildings twist and lean inward over narrow alleyways, creating spaces that seem to enclose and oppress the

inhabitants beneath them. Rooftops curl upward at sharp angles, doorways are warped and asymmetrical. The ghetto as a whole serves as a spatial embodiment of historical pressure, reflecting a community shaped and deformed by centuries of persecution.⁶

This positions architecture as visual, materialized cultural memory. Poelzig was not attempting historical accuracy in any conventional documentary sense, as the actual Prague ghetto of the 16th century looked nothing like his set, but was instead translating the emotional and cultural weight of that history into spatial form. His set design collapses temporal boundaries of the medieval ghetto as it actually was, the ghetto as it existed in cultural memory, and the ghetto as a symbol of ongoing persecution in Weimar Germany, all coexisting simultaneously in the same architectural space.^{5,6} The viewer does not experience these as separate historical layers to be analyzed in sequence but as a single, durational environment to be inhabited intuitively.

For contemporary digital heritage practice, Poelzig's approach raises a crucial question that 3D documentation projects often fail to engage. Is heritage preservation primarily a documentary act, capturing what actually existed, or an interpretive act, communicating the cultural meaning of what existed? LiDAR scanning and photogrammetry excel at the former, as they can produce millimetrically accurate models of physical structures. But they do not, by themselves, capture the experiential and cultural weight that Poelzig achieved through deliberate architectural distortion. The most sophisticated digital heritage platforms, those that truly fulfill the promise of durational experience, will need to integrate documentary precision with interpretive richness, much as Poelzig integrated historical reference with expressionist transformation.

3.2. *Metropolis* (1927): Erich Kettelhut and the architecture of temporal stratification

Fritz Lang's *Metropolis* (1927) represents a different and equally significant moment in the history of cinematic architectural heritage. The film's production designer, Erich Kettelhut, created one of the most ambitious imaginary cityscapes in cinema history. A vertical city divided between a luminous upper world of towers, gardens, and elevated motorways, and a subterranean underworld of industrial machinery and worker dormitories. The visual language of this city is explicitly architectural rather than scenographic. Kettelhut drew extensively on the contemporaneous New York skyline, Art Deco ornament, and the formal principles of Modernist urbanism⁷ to create a fictional city that was simultaneously futuristic and

familiar, visionary, and cautionary.^{7,8}

The specific technique used to realize *Metropolis*'s architecture is directly relevant to the prehistory of digital heritage practice. The Schüfftan Process, invented by cinematographer Eugen Schüfftan for this film⁹, used strategically positioned mirrors to combine live actors with scale architectural models, creating the illusion of performers inhabiting vast spaces that physically existed only as miniatures. This technique accomplishes, through optical means, precisely what AR accomplishes through digital means—the seamless overlay of two distinct physical realities into a single coherent visual experience. When we use AR to superimpose a digital reconstruction of a destroyed building onto photographs of its current ruins, we are implementing the same fundamental principle that Schüfftan developed in 1926: the intuition that cultural memory is best communicated through immersive visual experience.⁹

The vertical stratification of *Metropolis*'s city also carries direct relevance for thinking about digital heritage as a form of temporal archaeology. The bifurcated structure of luxury above and labor below is a spatial metaphor for the temporal structure of heritage itself. The visible, celebrated layer of historical achievement that occupies public discourse and cultural imagination contrasts with the invisible, occluded layer of the labor, conflict, and social struggle that produced it. Contemporary platforms that present architectural monuments without historical and social context reproduce *Metropolis*'s upper city without the lower, an aesthetically impressive but intellectually incomplete representation of cultural memory. The most philosophically sophisticated digital heritage applications will, like Lang's film at its best, keep both layers visible simultaneously.

3.3. The Schüfftan process and stop-motion as proto-digital technologies

The technical innovations of Weimar cinema can be read as systematic responses to the same fundamental challenge that drives contemporary digital heritage: how to make absent physical environments present to contemporary audiences.⁹ *The Golem*'s combination of live action and stop-motion animation, in which inanimate materials are given the appearance of continuous movement through sequential still photography, anticipates, in structural terms, the photogrammetric reconstruction process by which contemporary heritage practitioners create 3D models from sequences of still photographs. In both cases, a series of discrete, static images is processed to generate an experience of continuous spatio-temporal presence.

The parallel is more than superficial. Stop-motion

animation served to animate the clay figure, to give material form to apparent life and movement. In digital photogrammetry, the processing of sequential photographs serves to animate the ruins, to give damaged or destroyed material form apparent completeness and presence. Both are acts of technological resurrection, using cinematic or computational means to restore apparent life to what would otherwise be inert matter or absent space. Bergson's concept of *durée* illuminates this resonance, as both techniques achieve the collapse of the temporal boundary between the inanimate past (the clay figure before the incantation; the ruins after the destruction) and the animated present (the monster as it moves through the medieval city; the heritage site as it appeared before its damage).¹

4. Digital cultural heritage: Contemporary applications of Bergsonian and Bosanquetian frameworks

4.1. Temporal fluidity in digital heritage platforms

The concept of *durée* finds its most striking contemporary expression in the design of digital heritage platforms that present multiple temporal states of a single site within a unified experiential environment. The CyArk digital documentation of the ancient Nabataean city of Petra provides an exemplary case study.¹⁰ The users access CyArk's virtual environment of this United Nations Educational, Scientific, and Cultural Organization World Heritage Site in Jordan and engage with a layered temporal reality: the site's ancient construction and its 20th-century intact state, documented through scholarly surveys and tourist photographs. These are not presented as discrete historical periods to be selected from, but as interpenetrating temporal layers coexisting within a single digital environment.^{11,12}

This is an approximation of genuine *durée*.¹ The digital visitor does not move through a linear historical sequence but inhabits a continuous temporal flow in which past and present coexist as qualitative multiplicities rather than quantitative successions. This is categorically different from traditional museum presentation, where the past is fixed as a stable object, and the visitor occupies a separate, observational present. The CyArk environment collapses this observer/object distinction, positioning the digital visitor within a temporal field rather than in front of a temporal display.

The digital documentation of Notre-Dame Cathedral following its 2019 fire provides a second, architecturally specific case. Art historian Andrew Tallon had conducted a comprehensive LiDAR survey of the cathedral in 2015, capturing billions of data points at five-millimeter accuracy,

producing a digital twin that preserves the spatial character of the building in extraordinary detail.¹¹ The conservation architects and engineers engage simultaneously with the cathedral's medieval construction (begun 1163), its series of historical modifications, its pre-fire 21st-century condition, and the work of contemporary reconstruction. The digital model does not represent any single historical moment of the building, but rather embodies its temporal continuity. This is the duration instantiated in architectural data, from which any particular temporal cross-section can be extracted without the whole ever being reduced to any one of its moments.¹¹

4.2. Participatory preservation and collective memory

Bosanquet's dialectic of individual expression and universal cultural significance finds its most powerful contemporary expression in crowdsourced digital heritage preservation. The reconstruction of Palmyra's Temple of Bel following its 2015 destruction illustrates this process with unusual clarity.¹³ The temple was not documented through professional surveys but through photogrammetric processing of tourist photographs, individual snapshots taken by hundreds of visitors over the preceding decades, each representing a personal memory, an aesthetic choice, a subjective response to the monument. Through computational aggregation, these individual acts of personal documentation were transformed into a comprehensive 3D model serving universal cultural preservation goals.¹³

This transformation is aesthetic and philosophical rather than technical. Each tourist photograph embodies a unique subjective perspective on a universally significant object, shaped by the particular sensibility, knowledge, and emotional engagement of the individual who took it. The photogrammetric processing that aggregates these photographs into a comprehensive model accomplishes, through algorithmic means, exactly what Bosanquet describes as the dialectical resolution of individual and universal. The particular subjective responses of individual visitors are preserved, while simultaneously being transcended into a universal representation that serves collective cultural purposes.

The #NewPalmyra project extended this participatory model through explicit digital collaboration. An international community of volunteers contributed photographic documentation, computational processing, and design expertise to the 3D reconstruction of Palmyra's monuments. The project simultaneously embodied individual/universal dialectic, as each volunteer's contribution was simultaneously personal and collective,

and duration, as the reconstruction collapsed the temporal boundary between the site's destroyed past and its virtually restored present.^{1,13} Similar dynamics characterize the CyArk initiative, which collaborates with local communities at heritage sites, training residents in 3D scanning, photogrammetry, and digital modeling.^{10,14,15} This approach ensures that digital preservation reflects both the individual, lived experiences of community members with deep cultural connections to sites, and the universal preservation standards required for global accessibility and scholarly research.^{15,16,17}

The Million Image Database project, which crowdsourced photographs of at-risk Middle Eastern heritage sites, further extends this model.¹⁸ The project demonstrates how individual acts of documentation can aggregate into a collective digital archive of enduring cultural value when physical sites face destruction. In each case, the critical philosophical point is the same: individual acts of subjective engagement with cultural heritage do not only preserve personal memories but, when digitally aggregated, constitute collective cultural memory and the universal cultural significance built from the accumulation of individual subjective responses.^{12,19}

4.3. Architectural digitization and spatial preservation

The specific application of digital technologies to heritage preservation connects the philosophical frameworks developed above to the technical and professional concerns of architectural practice. 3D digitization technologies, such as LiDAR scanning, close-range photogrammetry, structure-from-motion processing, and building information modeling integration, have transformed architectural documentation from a labor-intensive, analogue process of measured drawing and photographic survey into a high-resolution digital practice capable of capturing spatial information at scales and resolutions previously unattainable.^{15,16,20,21}

For architectural heritage specifically, these technologies address a fundamental problem of preserving the temporal layering of built fabric. Historic buildings are not single-moment constructions but palimpsests²², the accumulations of construction, modification, damage, repair, and addition over centuries or millennia. A traditional architectural survey must make choices about which state of the building to represent, while a comprehensive digital model can preserve all legible states simultaneously. When the digital model of a historic building captures both its medieval core and its 19th-century restoration interventions as distinct but coexisting layers of spatial data, it embodies exactly the

duration that Bergson was describing in the same decade that Poelzig was designing *The Golem's* ghetto—a temporal reality in which multiple historical moments coexist as a qualitative multiplicity rather than being reduced to a linear sequence.¹

Photogrammetric documentation methodology, as demonstrated in archaeological and conservation applications, offers particularly compelling evidence of this Bergsonian character of digital architectural preservation. Software such as Agisoft Metashape allows professionals to create high-resolution 3D models of architectural elements that serve multiple simultaneous purposes.^{23,24} Digital elevation models show precise deformations in mosaic floors or masonry surfaces that guide conservation interventions, orthographic projections enable accurate planning without repeated physical access to fragile structures, and sequential scans create temporal monitoring records that capture continuous change. This last function is the most philosophically significant. The digital model does not capture a frozen moment of the site's existence but the ongoing temporal flow of its life: decay, intervention, recovery, the continuous becoming as the nature of genuine temporal experience.

The connection to the architectural sets of Weimar cinema is more than analogical. The elaborate physical constructions that Poelzig built for *The Golem* and Kettelhut designed for *Metropolis* were ephemeral, temporary structures built to serve a specific cultural purpose and then dismantled. Today, the lost architectural worlds of Weimar cinema could themselves be subjects of digital reconstruction, using the same photogrammetric techniques applied to Palmyra and Notre-Dame. The production stills, architectural drawings, and film frames documenting Poelzig's ghetto could be processed into 3D reconstructions of those lost spaces. The architecture of Weimar cinema, which itself functioned as a form of cultural memory preservation, could be preserved in turn through the digital techniques that it anticipates.

4.4. Immersive technologies and embodied engagement

Virtual reality and AR heritage applications represent the fullest contemporary realization of the principles that both Bergson and Weimar cinema articulated: the creation of immersive environments in which cultural memory is not observed from a distance but inhabited and experienced from within.^{25,26} Bergson's insistence on the inadequacy of analytical knowledge and the necessity of intuitive, direct engagement with reality finds its clearest technological expression in VR heritage environments that position the user inside a virtual reconstruction rather than in front of

it.¹

The Google Arts and Culture Open Heritage Project provides 3D virtual tours of heritage sites including Pompeii, Mesa Verde cliff dwellings, and the Mayan Temple of Kukulcan that enable intuitive heritage experience and continuous spatial navigation through environments without the temporal and spatial interruptions, such as the closing time and the physical distance between sites, that characterize traditional museum or site visits.²⁷ Users move fluidly through these digital environments in a mode that approximates continuous, uninterrupted, embodied engagement with cultural space across historical periods and geographic distances.^{24,27}

The virtual reconstruction of the Roman Theatre of Palmyra offers a particularly instructive case for Bergsonian analysis.¹³ The reconstruction allows users to experience the theatre in multiple temporal states: as it appeared in antiquity, with its decorative program intact as it existed in the decades before 2015, and as it stands now in its ruined condition, as simultaneously accessible aspects of a single spatial reality. This is the fullest realization of Bergsonian *durée* in a heritage context.¹ The qualitative multiplicity of temporal states exists not in sequence but in coexistence, accessible through intuitive navigation²³ rather than analytical selection.

Augmented reality heritage applications develop the Schüfftan Process lineage in a particularly direct way. Platforms like the National Museum of Natural History's "Skin and Bones" AR application superimpose digital reconstructions onto physical objects, overlaying moving, fleshed reconstructions onto skeletal remains.²⁸ These achieve a seamless combination of physical presence and virtual reconstruction into a single experiential field, exactly what Schüfftan achieved through optical means in *Metropolis*.^{4,9} The physical and the digital, the present and the reconstructed past, coexist in a single perceptual reality rather than being offered as alternatives. This is AR's fundamental philosophical contribution to heritage practice: the refusal of the binary between the authentic ruin, available to direct experience but stripped of its original meaning, and the complete reconstruction, interpretively rich but experientially disembodied. Instead, it offers the synthesis of both in a single, simultaneous perceptual field.^{27,29}

4.5. Ethical considerations: Authenticity, access, and digital mediation

The philosophical frameworks developed here also illuminate the ethical dimensions of digital heritage practice in ways that purely technical discussions cannot. Bergson's critique of analytical knowing raises important

questions about the relationship between digital precision and cultural authenticity.³⁰ A LiDAR scan captures the spatial geometry of a building with extraordinary fidelity, but does it capture the building's cultural significance? Does the digital twin of Notre-Dame Cathedral preserve the centuries of devotional practice, aesthetic response, and cultural memory that have accrued to those vaults? These are not questions that technical documentation can answer, as they require the kind of qualitative, interpretive engagement that can be associated with intuition.³⁰

Bosanquet's framework raises complementary ethical concerns about representation and access. If the significance of digital heritage preservation lies in its capacity to synthesize individual subjective experiences into universal cultural resources, then the ethical imperative is to ensure that the individual contributions reflect the perspectives of diverse visitors rather than a homogeneous, privileged demographic. The crowdsourced digital archive is only as culturally inclusive as the crowd that sources it. Bosanquet's dialectic reminds us that the universal is only genuinely universal when it genuinely reflects the breadth of individual human experience.²

The anxieties about technology depicted in both *The Golem* and *Metropolis* remain relevant here. Both films present technology as a double-edged force, capable of creating and protecting but also of destroying and oppressing. Contemporary digital heritage faces analogous tensions. The same digital platforms that democratize access to cultural heritage can also commercialize it, trivialize it, or render it accessible only to those with sufficient technological infrastructure. The concern about the spatialization of time is precisely the risk that poorly designed digital heritage applications pose—the transformation of living cultural memory into a data product, comprehensive in its coverage and hollow in its meaning.

5. Discussion: Findings, implications, and contributions

5.1. Findings

The comparative analysis conducted in this paper yields four principal findings concerning the relationship between early modernist philosophical aesthetics, Weimar cinematic practice, and contemporary digital heritage.

First, the Bergsonian concept of *durée* is not merely analogously applicable to digital heritage experience—it describes with precise conceptual vocabulary what the most sophisticated digital heritage platforms actually achieve. The CyArk Petra environment, the Notre-Dame digital twin, and the Palmyra virtual reconstruction each

instantiate the qualitative coexistence of multiple temporal states within a single experiential field. This is the structural feature that distinguishes these platforms from traditional museum presentation, and it corresponds exactly to Bergson's distinction between spatialized time (discrete, sequential, analytical) and genuine duration (continuous, interpenetrating, intuitive).¹

Second, the Bosanquetian individual–universal dialectic describes with equal precision the philosophical logic of crowdsourced digital preservation. The aggregation of tourist photographs into the Palmyra 3D model, the CyArk community documentation model, and the Million Image Database project all instantiate the same structure: individual, subjective acts of documentation are preserved in their particularity while being simultaneously transcended into a universal cultural resource. This transformation is aesthetic in Bosanquet's sense—it is the production of universal cultural significance from the accumulation of individual subjective responses.²

Third, the technical innovations of Weimar cinema—the Schüfftan Process, stop-motion animation, and Poelzig's interpretive set design—can be understood as structural precedents for contemporary digital heritage practice, not metaphorical analogies.^{4,9,5} Each Weimar technique addresses, through cinematographic means, the same fundamental problem that digital heritage addresses through computational means: the creation of environments in which absent or destroyed cultural spaces become present and inhabitable. The structural homology between photogrammetric reconstruction and stop-motion animation, and between AR overlay and the Schüfftan Process, is precise enough to constitute a traceable intellectual genealogy.

Fourth, the comparative analysis reveals a tension in current digital heritage practice between documentary fidelity and interpretive richness that the philosophical frameworks help to theorize. Poelzig's deliberate distortion of historical accuracy in the service of cultural meaning represents one resolution of this tension; LiDAR-based exact reconstruction represents another. Neither is intrinsically superior—the appropriate resolution depends on the cultural purpose of the specific platform. The philosophical frameworks provide the conceptual vocabulary to articulate this choice explicitly, rather than treating documentary precision as a self-evident default.

5.2. Implications for practice

These findings carry four implications for the design and evaluation of digital heritage platforms.

The first implication, derived from the finding on *durée*, is the primacy of temporal continuity over historical

discreteness in platform design. The most philosophically adequate digital heritage platforms will present heritage sites as temporal continua in which multiple historical phases coexist as interpenetrating aspects of a single living entity. This requires not only technical capacity—the ability to store and navigate multiple temporal states of a digital model—but interpretive intention: the deliberate choice to represent heritage as process rather than product, as becoming rather than being.

The second implication, derived from the finding on participatory preservation, is that crowdsourced documentation models are not practically useful supplements to professional heritage practice but philosophically fundamental to it. The crowdsourced photograph is not a poor substitute for the professional survey; it is a different and complementary form of heritage documentation, one that captures the affective and experiential dimensions of a site that technical measurement cannot reach. Platform design should reflect this philosophical parity.

The third implication, derived from the finding on Weimar cinema, is the creative legitimacy of interpretive reconstruction. Just as Poelzig's expressionist distortions of historical architectural form were successes of cultural communication, digital heritage platforms are entitled to prioritize cultural meaning over documentary fidelity when a specific platform's purpose demands it. The philosophical frameworks developed here suggest that the binary between accuracy and interpretation is a false one, as the most culturally valuable digital heritage environments integrate both.

The fourth implication concerns the ethical responsibilities that attend technological mediation of cultural memory. Both Bergson's critique of analytical knowing and the anxieties depicted in *The Golem* and *Metropolis* converge on the same warning: the reduction of living, dynamic, qualitative experience to static, quantifiable representation forecloses the possibility of genuine cultural engagement.^{1,3,4} This risk is precisely what poorly designed digital heritage applications pose—the transformation of living cultural memory into a data product, comprehensive in its coverage and hollow in its meaning. Platform designers must maintain ongoing critical reflection on what forms of experience their choices enable and what forms they exclude.

5.3. Theoretical contribution

This paper contributes to digital heritage theory in two respects. First, it establishes duration and aesthetic dialectic as productive analytical frameworks for digital heritage scholarship—frameworks that offer greater conceptual

precision for the temporal and participatory dimensions of digital heritage than the descriptive and technical literature has previously provided. Second, it proposes the category of the “proto-digital heritage practice” to describe the structural precedents in Weimar cinema, offering digital heritage studies a historical genealogy that extends its intellectual lineage back to the first decade of technological mass-cultural mediation.

5.4. Practical contribution

For heritage practitioners and platform designers, the paper translates its philosophical analysis into four evaluative principles: temporal continuity, participatory parity, interpretive legitimacy, and ethical vigilance. These principles function as design criteria against which specific platforms can be assessed—not to produce a ranking, but to make explicit the philosophical commitments that any platform design already embeds, whether consciously or not.

6. Conclusion

The integration of early 20th-century philosophical aesthetics with current digital heritage practice proposed in this paper is a discourse on contextuality and continuity. Bergson and Bosanquet were working at the inaugural moment of technologies such as cinema, photography, and mechanical reproduction that would fundamentally reshape the relationship between humans and cultural memory. Their philosophical responses to that transformation were developed in direct dialogue with the cultural problems it posed, and those problems have not been superseded by subsequent technological developments; rather, they have been intensified by them.

The Weimar filmmakers of *The Golem* and *Metropolis* were working within the same intellectual context as Bergson and Bosanquet, and their architectural and cinematic innovations can be read as practical experiments in the aesthetic problems these philosophers were theorizing. The elaborate sets, the optical special effects, the immersive visual environments of Weimar cinema were proto-digital heritage practices, the attempts to use technology to create environments in which cultural memory could be inhabited, rather than observed. The continuities between those early cinematic experiments and contemporary VR/AR heritage applications are deep structural homologies, connecting the fundamental challenge of using technology to mediate human relationships with cultural memory across time.

The contribution of this article to heritage discourse is therefore twofold. Empirically, it identifies specific philosophical frameworks as conceptual resources for

heritage practitioners working with digital environments, illuminating the temporal, participatory, and ethical dimensions of engagement with a precision and depth that more recent theoretical literature has not achieved. Theoretically, it demonstrates the enduring relevance of early modernist philosophical aesthetics to contemporary cultural practice, and suggests that the digital cultural sphere is not a radical break from 20th-century culture but its continuation by technological means, and the fulfillment, in virtual environments, of the aspirations that Bergson articulated in *Introduction to Metaphysics* and that Wegener and Lang enacted in the first great age of cinematic architecture.

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