



Virtual collective consciousness in metaverse communities: Sociological insights from collective effervescence and networked sociality

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ABSTRACT

This study investigates the emergence of virtual collective consciousness (VCC) during symbolic social rituals in metaverse environments. Drawing on Durkheim's theory of collective effervescence and Castells' concept of networked sociality, the study examines how co-performed activities relate to shared identity and group affiliation in digital spaces. A ritualized beach gathering was staged in a university-hosted metaverse platform, where 68 students recruited through targeted outreach participated in synchronized symbolic actions, including countdowns, avatar emotes, and the communal observation of a virtual sunset. Designed to simulate digitally mediated ritual, the event provided a context for examining affective engagement, social connection, and symbolic participation. Findings showed that emotional engagement and ritual participation were positively related to collective identity, whereas behavioral indicators such as avatar synchrony and spatial proximity were not significant predictors. Prior metaverse experience was linked to greater emotional engagement but showed no significant relationship with identity formation. Collective identity was also statistically implicated in an indirect association between emotional engagement and reported intentions to reconnect with the virtual community. Exploratory factor analysis suggested an indicative two-dimensional structure of VCC, comprising socio-emotional immersion and symbolic participation. These results suggest that meaningful group connection in virtual settings may depend more on shared emotional symbolism than on visible coordination alone. Overall, the findings provide associational evidence on how virtual rituals may relate to perceived social bonds, with implications for sociological theory and the design of collective experiences in digital environments.

1. Introduction

The metaverse is broadly understood as an immersive virtual environment in which users interact through avatars in real time (Ritterbusch & Teichmann, 2023). In recent years, it has gained increasing significance in cultural and sociological discourse because of the social forms it enables and the symbolic practices it organizes (Buana, 2023; Tan et al., 2025). Its significance stems from its socio-cultural affordances that structures participation, mediates identity work, supports symbolic interaction, and contributes to the production of collective meaning (Hennig-Thurau et al., 2023; Reis et al., 2024; Wang et al., 2025). Once closely associated with gaming subcultures, the metaverse has expanded into an experimental setting for cultural performance (Yang, 2023), education (Lampropoulos et al., 2025),

healthcare (Li et al., 2024), remote labor (Vakeel et al., 2025), tourism (Jiang, 2025), and economic and organizational applications (Brenk et al., 2026; Gandhi et al., 2024). More broadly, it has become a socio-technical space where identity, social relations, and collective experience are organized through platform-based infrastructures and immersive forms of mediation (Dwivedi et al., 2024; Reis et al., 2024).

Ritualized participation has become one of the clearest sociological expressions of this shift. School events (Jover & Sempere, 2025), religious observances (Adria, 2024), civic gatherings (Edelblum & Giesler, 2025), sports events (Li & Jia, 2025), and virtual festivals (Sharma et al., 2025) show how immersive environments can gather geographically distributed participants around shared moments of attention, coordinated action, and affective intensity. These practices signal a cultural shift in how communal experiences are staged, inhabited, and

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interpreted under conditions of digital mediation. In such environments, ritual does not simply persist as a replicated social form but is reshaped through the affordances of avatars, spatial simulation, real-time interaction, and digitally orchestrated copresence. Rather than as dispersed individuals connected through screens, participants gather as embodied social actors within a shared symbolic environment, where gestures, movement, visibility, and coordinated participation can acquire collective significance. Immersive platforms may therefore intensify the experiential qualities of ritual by making togetherness spatially perceptible, affectively charged, and symbolically sustained in ways that differ from more fragmented forms of online interaction. Considering these trajectories, the metaverse provides a critical environment for examining how ritual practices and symbolic interactions generate solidarity, collective identity, and affective resonance under conditions of mediated copresence and networked sociality.

Collective consciousness (CC) offers a productive analytic lens for this inquiry. Durkheim (1912) conceptualized it as the ensemble of shared beliefs, values, and moral orientations that bind individuals into a cohesive social group. Far from being reducible to aggregated individual perceptions, CC operates as a supra-individual force that acquires durability through ritual enactments, symbolic circulation, and institutionalized practices (Belvedere, 2023; Olaveson, 2001; Shteynberg, 2024). It crystallizes in moments of heightened social intensity, where affective energies converge to produce solidarities that exceed the sum of their parts. In educational contexts, this dynamic can be observed in classroom rituals, graduation ceremonies, and shared digital learning environments that cultivate a sense of belonging beyond individual attendance or participation (e.g., Kelmendi & Pajaziti-Drançolli, 2025). These practices provide students with moral and symbolic frameworks for collective identification. From a sociological perspective, CC draws attention to the shared repertoires of meaning that stabilize group cohesion and generate affective resonance. These repertoires allow communities to negotiate boundaries, reaffirm norms, and sustain continuity across changing media ecologies. This orientation makes the concept particularly relevant for studying mediated copresence in the metaverse, where technologically arranged environments may support new forms of ritual participation, symbolic attachment, and digitally sustained solidarity (Beltramini, 2025).

As metaverse environments increasingly function as sites of education, work, ritual, and public assembly, they are no longer peripheral digital experiments but emerging infrastructures of social life (Aziz et al., 2025; Jabeen et al., 2026; Wang et al., 2022). Understanding how collective orientation, solidarity, and belonging are constituted in these environments therefore matters for sociological theory and for broader questions about how digital technologies organize social participation at scale. These processes influence how individuals come to recognize themselves as members of technologically mediated publics, influencing patterns of inclusion, attachment, and continuity within virtual communities. As immersive systems become more normalized in everyday social interaction, their capacity to organize shared emotion and symbolic participation may have lasting consequences for how collective life is formed, sustained, and governed under conditions of technological mediation. Consequently, clarifying these dynamics is especially pressing at a time when immersive platforms increasingly shape social experience beyond entertainment and extend into domains with enduring societal significance.

2. Background of the study

2.1. Virtual collective consciousness

Virtual collective consciousness (VCC) extends Durkheim's classic notion of CC into digitally networked environments. In Durkheimian sociology, CC refers to the shared values, beliefs, and meanings that bind communities together. Digital environments, however, require a more context-sensitive refinement of this concept (e.g., Rathke et al., 2023).

Alperstein (2019) argues that online interaction and mediated rituals call for a reconsideration of CC beyond face-to-face assemblies, as digital environments reshape how individuals coordinate affect, identity, and belonging. Building on this perspective, the present study defines VCC as a supra-individual orientation that emerges when participants in a digitally mediated environment experience themselves as part of a symbolically unified collective. Consistent with Durkheim's original formulation, VCC is not reducible to interpersonal awareness or momentary interaction but denotes a shared moral-symbolic framework through which emotion, meaning, and group identification are collectively oriented. For VCC to be present, three core characteristics must converge: (1) *shared symbolic reference*, whereby participants orient toward common ritual elements, narratives, or symbolic focal points; (2) *perceived shared emotional experience*, in which individuals experience their affective responses as mutually aligned with others; and (3) *emergent collective identity*, defined as a felt sense of "we-ness" that situates the individual within a larger social whole. While behavioral coordination and technological immersion may intensify these processes, they are facilitative rather than constitutive conditions of VCC. Importantly, this conceptual extension does not presume that virtual environments supplant offline collective life but rather treats them as a bounded sociotechnical context in which CC can be analytically examined as a context-dependent orientation under conditions of technological mediation.

This conceptualization connects with scholarship on digitally networked environments that generate shared affect, coordinated orientation, and symbolic alignment among dispersed collectives (Liu, 2018). These dynamics are shaped by platform architectures, algorithmic mediation, and governance structures that influence how collective experience is organized, amplified, and sustained. Although related studies do not always use the language of VCC, they provide empirical illustrations of these processes (e.g., Garcia, 2025; Hennig-Thurau et al., 2023; Raman et al., 2025). This framing enables VCC to be examined as an emergent collective outcome rather than a technological artifact. Accordingly, research on immersive environments shows that digitally mediated rituals can elicit emotional attunement and identity consolidation in ways that echo solidarities observed in co-present ceremonies (Hennig-Thurau et al., 2023; Mizrahi-Werner et al., 2024; Oh et al., 2023). Parallel work in therapeutic and psychosocial domains shows that metaverse-based interactions can enable participants to cultivate resilience, foster solidarity, and mobilize affective support (Ahn & Lee, 2023; Hasei et al., 2024). Conceptually, VCC is best understood as a second-order construct that integrates affective, symbolic, and identificatory dimensions of digitally mediated collectivism. It remains analytically distinct from social presence, perceived community, and online collective action because it captures the emergence of a shared moral-symbolic orientation rather than perceptual co-presence or coordinated behavior alone. These perspectives show the conceptual value and empirical plausibility of extending Durkheimian insights into technologically mediated forms of collective life.

2.2. Collective effervescence

Collective effervescence is one of Durkheim's most influential concepts and remains central to his account of ritualized social life. Introduced in *The Elementary Forms of Religious Life* (Durkheim, 1912), the concept refers to the intense emotional energy that arises when individuals gather and participate in shared rituals. During such moments, people may experience a sense of fusion with the group and an awareness of belonging to something greater than themselves (Kronsted, 2025). Religious ceremonies, national celebrations, and mass protests exemplify how collective effervescence strengthens cohesion and shared meaning through heightened emotional synchrony (e.g., Gabriel et al., 2024). For Durkheim, collective effervescence is expressive and generative. It reaffirms shared moral boundaries and renews commitment to collective ideals. The emotional intensity of ritual temporarily lifts

participants beyond ordinary routines, allowing the group to experience itself as a morally unified entity. This heightened affect does not come from any single individual. It develops through reciprocal emotional amplification within the assembled group. Collective effervescence therefore functions as an affective mechanism through which social solidarity is periodically produced and sustained. While CC provides the enduring framework of values and meanings, collective effervescence captures the experiential process through which that framework is revitalized. Therefore, effervescence is better understood as a transient intensification of affect that emerges through ritualized interaction and dissipates once the ritual moment subsides.

This processual understanding is particularly relevant for analyzing ritualized interaction in digitally mediated environments. Recent scholarship suggests that emotionally intensified collective experiences can arise in virtual and platform-mediated settings, even without physical co-presence, when interaction is organized around shared symbolic focus and coordinated participation (Dwivedi et al., 2024; Raman et al., 2025; Vakeel et al., 2025). In metaverse contexts, collective effervescence may be understood as an emotional surge generated through ritualized engagement. It is less dependent on bodily co-presence and more closely tied to the orchestration of attention, symbolic focus, and shared emotional pacing within the platform. This shift shows how technologically mediated environments can reconfigure the conditions under which collective emotional intensification occurs. High-profile events such as Travis Scott's 2020 Fortnite concert (Moritzen, 2022), Roblox-based religious gatherings (Thomas et al., 2024), and VR graduation ceremonies during the COVID-19 pandemic (Xu, 2023) illustrate how participants may experience emotional synchrony and symbolic attachment through avatars, music, and shared ritualized gestures. Consistent with this interpretation, the present study operationalizes collective effervescence indirectly through participants' reported emotional engagement and depth of ritual participation. These variables serve as empirically accessible indicators of affective intensification during the virtual ritual. Rather than measuring effervescence as a stand-alone construct, this approach reflects its theorization as a momentary emotional process that contributes to VCC while remaining analytically distinct from its more enduring formation.

2.3. Networked sociality

Alongside Durkheim's concepts of CC and collective effervescence, Castells' theorization of networked sociality offers a complementary framework for understanding social dynamics in the metaverse. Whereas Durkheim foregrounds the ritual foundations of moral cohesion, Castells (2000) situates sociality within the contemporary information society, where relationships are fluid, interest-based, and selectively maintained through digital platforms rather than anchored primarily in enduring institutions. From this perspective, social connections are increasingly mediated by information technologies, as individuals assemble personal networks around shifting affiliations, interests, and goals. Castells (2004) extends this argument by emphasizing the cultural and communicative dimensions of networked relations, particularly how technological infrastructures shape the organization and meaning of social interaction (Castells, 2009). Networked sociality foregrounds the structural conditions through which social ties are formed, sustained, and dissolved. It emphasizes flexibility, connectivity, and the role of platforms as mediating architectures rather than neutral channels of interaction. It also shifts attention away from bounded communities and toward dynamic constellations of connection that are continuously reconfigured through digital mediation. Social belonging, in this viewpoint, is sustained through ongoing participation within overlapping networks of interaction. These networks are shaped by platform logics, communicative norms, and algorithmically structured visibility, all of which influence who connects, how connections persist, and which forms of interaction become socially salient. Networked sociality therefore provides a structural account of social

organization that complements ritual-based explanations of cohesion.

This framework is useful for the present study because it foregrounds the infrastructural and relational architectures that enable digitally mediated rituals to occur. Metaverse environments exemplify this logic, as ritual-like gatherings arise through symbolic participation, shared interests, and affective engagement orchestrated by digital infrastructures. Even when temporary or episodic, such connections can facilitate information-seeking, emotional support, and collective identification (Ahn & Lee, 2023; Oh et al., 2023). From this perspective, the metaverse operates as a social infrastructure that fosters ephemeral yet meaningful communal experiences. Castells' insights help clarify the networked conditions under which VCC emerges. Networked sociality also explains how individuals move fluidly across multiple virtual gatherings while sustaining a sense of connection that does not depend on stable or exclusive group membership. At the same time, this fluidity raises questions about the durability of solidarity and the mechanisms through which fleeting encounters acquire collective significance. By situating ritualized participation within networked infrastructures, the present study bridges structural accounts of digital connectivity with affective and symbolic processes of collective orientation. Existing scholarship, however, has remained disproportionately focused on technological affordances (Garcia, 2025), leaving the processes of solidarity, moral orientation, and collective attunement in metaverse sociality less fully examined. This imbalance is also noted in recent metaverse studies, which argue that metaverse adoption, retention, and resistance cannot be understood without attention to users' psychological ownership, collective valuation, and societal risk perceptions (Fan et al., 2026; Park & Kim, 2025; Ren et al., 2025).

3. Empirical gaps and research questions

Although scholarly interest in the metaverse has grown rapidly in recent years, most studies have focused on individual-level user experiences. Comparatively less attention has been given to group-level processes, particularly how collective identity, affective synchrony, and symbolic alignment emerge through ritualized participation in virtual environments. By privileging the individual as the primary unit of analysis, existing research often overlooks the intersubjective and supra-individual dimensions of digitally mediated social life. Moreover, the concept of VCC remains underdeveloped within metaverse scholarship. Although theorists have suggested that online rituals and symbolic participation can generate shared affect and belonging (e.g., Liu, 2018), empirical investigations of VCC as a sociological construct remain scarce. Without closer empirical and theoretical attention, the concept risks remaining largely metaphorical rather than developing into a robust framework for understanding solidarity in technologically mediated environments. Another unresolved issue concerns the relationship among emotional immersion, symbolic participation, and observable coordination in virtual rituals. Classical sociology has long emphasized the role of ritual in generating collective effervescence (Gabriel et al., 2024). However, whether embodied synchrony is necessary for solidarity in digital environments, or whether shared emotional symbolism alone can sustain enduring forms of collective orientation, remains unclear. Although networked sociality highlights the fluid and often ephemeral nature of digital ties, the relationship between these dynamics and ritualized experiences of belonging in the metaverse remains insufficiently theorized.

To address these gaps, the present study examines not simply whether collective dynamics occur within a metaverse environment, but how the metaverse may reorganize the conditions through which such dynamics emerge. The analytical significance of the metaverse does not depend on the assumption that platform-specific behaviors directly predict collective identity. Rather, it stems from the possibility that technologically mediated environments reshape how participants gather, direct attention, enact symbols, and experience co-presence in the absence of corporeal assembly. Drawing on both classical and

contemporary sociological perspectives, this study seeks to clarify how collective identity and affective resonance are configured when ritual participation is platform-mediated, avatar-based, and infrastructurally orchestrated. This orientation aligns with recent scholarship calling for approaches that move beyond adoption-focused and risk-focused models toward frameworks that account for affective engagement, collective meaning, and sustained social orientation in metaverse environments (Fan et al., 2026; Mvondo, 2025; Zheng & Nah, 2026; Zhou et al., 2024). The study thus contributes to ongoing debates concerning the durability of solidarity under mediated conditions and the sociological implications of ritual processes unfolding through immersive digital infrastructures. At the same time, the study does not seek to determine whether these processes are unique to metaverse environments relative to other forms of digital interaction. Instead, it offers a bounded empirical account of how such processes take shape within a specific metaverse-based ritual context. Against this backdrop, the study addresses the following research questions:

1. Do demographic factors and prior metaverse experience show associations with differences in emotional engagement and collective identity?
2. Are ritual participation, emotional engagement, avatar synchrony, and spatial proximity associated with collective identity?
3. Is collective identity statistically positioned within an indirect association linking emotional engagement and intentions to reconnect with the virtual community?
4. What dimensional structure characterizes virtual collective consciousness?

4. Materials and methods

4.1. Research design

This study employed a cross-sectional, single-group design to examine the emergence of VCC during a symbolic community event staged within a metaverse environment. The design enabled the immediate assessment of participants' psychological and behavioral responses following a shared virtual ritual. The cross-sectional format supported the analysis of relationships among key variables without experimental manipulation, while the single-group structure was appropriate for examining correlational, regression-based, and indirect association patterns. At the same time, the design does not permit comparative claims about whether the observed processes are unique to metaverse environments or whether similar dynamics would emerge in other digitally mediated collective settings. The study does not seek to establish metaverse exceptionalism. Rather, it provides a theoretically informed analysis of how collective orientation is enacted within a specific sociotechnical configuration of mediated ritual participation.

4.2. Analytical framework

Ritualization served as the primary analytical framework guiding event construction, variable selection, and interpretation. Alternative sociological approaches, such as social practice theory or communities of practice, offer valuable insights into routinized action, learning processes, and competence development within shared environments. However, these perspectives are less suited to examining temporally bounded, emotionally intensified, and symbolically charged collective moments. Ritual theory, particularly as extended through interaction ritual theory (Collins, 2004), foregrounds affective alignment, emotional entrainment, and symbolic condensation as processes through which supra-individual forms of collective experience emerge. This orientation directly shaped the staging of the metaverse event as a coordinated symbolic ritual and informed the operationalization of key constructs, including emotional engagement, ritual participation, and collective identity. Focusing on ritualized participation allowed the

study to examine how shared emotional salience and symbolic enactment generate a felt sense of "we-ness" that extends beyond routine interaction. In this sense, the design adopts an event-centered analytical lens, treating the ritual moment as a bounded yet generative site for observing the emergence of collective orientation. This analytical emphasis does not preclude the relevance of practice-based perspectives but rather reflects a deliberate focus on collective experience at moments of affective intensification.

4.3. Metaverse environment

To operationalize the research context, the study involved a researcher-designed ritual event that served as the central stimulus for data collection. The event was held in a custom-built, non-VR educational metaverse platform accessible through standard consumer devices without specialized hardware such as VR headsets. For this study, participants accessed the platform using desktop or laptop computers through a standalone software application installed before the session. Although a mobile version of the platform was available, all study sessions used desktop or laptop access to ensure consistency in navigation, display conditions, and behavioral recording. Originally developed as a digital twin of the host university's real-world campuses, the platform was reconfigured for this study to simulate a ritualized collective experience through a newly created immersive beach environment (Fig. 1). Interaction within the platform was supported through real-time avatar movement, spatial positioning, and pre-programmed gesture-based emotes, including waving, dancing, and synchronized movements. Text chat was available for informal communication, while voice communication was disabled to maintain consistency across participants and to foreground symbolic and visual modes of interaction.

Avatar customization was intentionally limited to standardized templates with adjustable basic features, such as clothing color and hairstyle. This design choice aligned with the study's focus on collective symbolism rather than individual self-presentation. The staged ritual included a sequence of coordinated activities, including a group countdown, synchronized avatar emotes, a choreographed group dance, a simulated sunset-watching moment as the symbolic climax, and a closing fire-circle designed to foster collective reflection. Minor latency in avatar movement was occasionally observed, but it did not disrupt the participants' ability to engage meaningfully in symbolic actions. Additional details on procedural design decisions, constrained platform affordances, affective pacing controls, and contingency protocols are provided in Appendix A.

4.4. Participants and procedures

A total of 68 university students participated in the study. Participants were recruited from a technological university in the Philippines offering degree programs in computer studies and engineering. Recruitment was conducted through targeted outreach to selected university classes related to the study's themes, including digital media, education, and emerging technologies. These courses were selected to ensure that participants had at least a foundational understanding of virtual environments or symbolic media experiences. Inclusion criteria required participants to be currently enrolled at the institution and to have at least basic familiarity with the university's metaverse platform. This requirement ensured baseline navigational competence and reduced technical barriers during the ritual event. Participation was voluntary, no incentives or compensation were provided, and all participants completed the full session. Given the emergent nature of VCC as a construct and the absence of established measurement models in metaverse-based ritual contexts, the study was designed as exploratory. The sample size aligns with commonly cited methodological guidance for exploratory factor analysis in early-stage research, which emphasizes factor interpretability, communalities, and theoretical coherence over strict subject-to-item ratios (de Winter et al., 2009). The study therefore



Fig. 1. Metaverse-based beach environment designed for shared ritual experience.

prioritizes conceptual clarification and pattern detection rather than definitive scale validation.

Prior to the study, all individuals provided informed consent through a digital ethics form. Participants accessed the virtual world at their scheduled session time and were greeted by a facilitator avatar. The ritual event followed a fixed 20-min sequence designed to simulate a communal symbolic experience and evoke a sense of shared emotional progression. The duration and structure of the ritual were intentionally time-bounded to minimize participant fatigue while preserving the symbolic integrity of the collective experience. The sequence began with a symbolic group countdown to mark a collective entry point. Participants then engaged in synchronized avatar emotes and a choreographed dance sequence using the platform's gesture controls, which were intended to foster performative alignment and social coordination. They subsequently turned toward the virtual horizon to watch a simulated sunset, which served as the emotional climax of the ritual. The event concluded with a virtual fire-circle intended to create a moment of collective reflection and closure. Throughout the experience, researchers recorded avatar behavior using screen-capture software for subsequent coding of indicators such as synchrony and spatial proximity. After the ritual, participants were redirected to a secure online questionnaire assessing emotional engagement, ritual participation, social presence, collective identity, and intentions to reconnect with the virtual community. The full session, including the ritual and the post-event survey, took approximately 35 to 40 min per participant.

4.5. Measures and behavioral indicators

Participants' experiences during the virtual ritual were assessed using a combination of validated self-report scales and behavioral observations. This mixed measurement approach was consistent with metaverse experience frameworks such as the META model (Garcia, 2025), which emphasizes that metaverse participation should be examined through subjective experience and observable interaction within the virtual environment.

Emotional engagement was measured using a scale adapted from affective immersion research (e.g., Lombard & Ditton, 1997), which captured responses such as feeling emotionally moved and forming lasting impressions ($\alpha = .86$). Ritual participation was assessed with a scale ($\alpha = .84$) measuring symbolic and performative involvement, including active participation and the perceived meaning of ritual elements such as the sunset and fire-circle. Social presence was evaluated using an adapted version of the Networked Presence Scale ($\alpha = .81$; Biocca et al., 2003), reflecting perceived co-presence and connection

with others in the virtual space. Collective identity was measured using a scale derived from social identity theory (e.g., Tajfel & Turner, 2004), emphasizing shared purpose and group belonging ($\alpha = .88$). Reconnection intentions were assessed using a scale developed for this study, which measured participants' intentions to return to future gatherings and maintain connections with group members ($\alpha = .79$).

These individual-level measures do not constitute direct observation of a supra-individual phenomenon but serve as empirically accessible indicators through which the emergence of VCC can be inferred. Additionally, behavioral data were obtained from video recordings and coded by two trained observers using a predefined behavioral coding scheme (see Appendix B). Interrater reliability was high for both synchrony (ICC = .91) and proximity (ICC = .87).

4.6. Data analysis

Data were analyzed using IBM SPSS (Version 28) and the PROCESS macro (Model 4) for statistical mediation testing. Given the cross-sectional nature of the data, mediation paths were interpreted as associative relationships rather than causal effects. Analyses addressed four primary RQs, using a combination of descriptive, inferential, and exploratory techniques. For RQ1, independent samples *t*-tests were conducted for gender, and one-way analyses of variance (ANOVA) were performed for academic level and metaverse experience levels. Effect sizes (η^2) were reported for group comparisons to quantify the magnitude of group differences. For RQ2, a standard multiple linear regression analysis was conducted. Ritual participation, emotional engagement, avatar synchrony, and spatial proximity were entered as independent variables. Standardized beta coefficients (β), *t*-values, and significance levels (*p*-values) were reported for all variables. For RQ3, an indirect association model was estimated using Hayes' PROCESS macro (Model 4) with 5000 bootstrap samples and bias-corrected 95% confidence intervals. Given the cross-sectional design, the model was interpreted as an indirect association rather than evidence of causal mediation, with statistical significance determined by whether the bootstrap confidence interval excluded zero. For RQ4, an exploratory factor analysis (EFA) was conducted on all relevant scale items using principal axis factoring with Promax rotation to examine a provisional item-level dimensional pattern. Given the modest sample size, the EFA is interpreted as indicative rather than confirmatory, with caution regarding factor stability and generalizability beyond the present context. Factor loadings above .40 were considered meaningful. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were examined to verify the suitability of the data for factor analysis. Descriptive

statistics, intercorrelations, and scale reliabilities (Cronbach's alpha) were reported to support the psychometric quality and internal consistency of all self-report measures.

5. Results

5.1. Descriptive statistics

Descriptive statistics for all study variables are presented in Table 1. Overall, participants showed consistently high levels of involvement across most dimensions of the virtual ritual experience. Emotional engagement ($M = 4.18$, $SD = .61$) and ritual participation ($M = 4.20$, $SD = .52$) reached the upper range of the scale, suggesting that the symbolic structure of the event was accompanied by high reported affective and participatory responses. Similarly, collective identity ($M = 4.02$, $SD = .67$) was rated highly, indicating that many participants experienced a meaningful sense of group affiliation during the session. Social presence ($M = 3.96$, $SD = .70$) and reconnection intentions ($M = 4.05$, $SD = .60$) were also elevated, indicating relatively high reported social presence and willingness to re-engage. Behavioral metrics indicated substantial coordination, with average avatar synchrony at 72% and spatial proximity at 68% of ritual time. These figures suggest high engagement in group behavior during the symbolic sequences.

5.2. Correlation matrix

Interrelations among key variables revealed a tightly connected network of subjective experience (Table 2). Emotional engagement was significantly correlated with collective identity ($r = .61$, $p < .01$) and reconnection intentions ($r = .57$, $p < .01$), suggesting that the emotional tone of the ritual was closely linked to how participants perceived their belonging and future involvement. Ritual participation was similarly associated with identity ($r = .64$, $p < .01$), while social presence correlated strongly with both identity ($r = .59$) and emotional engagement ($r = .56$). Observed behaviors such as avatar synchrony and spatial proximity showed only weak and non-significant relationships with the subjective measures. This pattern suggests a divergence between internal experience and visible behavior, which is vital for realizing how virtual collective experiences are formed. Overall, these patterns suggest that collective identity was more strongly associated with shared emotional and participatory experiences than in observable behavioral coordination.

5.3. RQ1: demographics and prior experience

The sample comprised 38 men (55.9%), 29 women (42.6%), and 1 nonbinary participant (1.5%), with ages ranging from 18 to 27 years ($M = 20.8$, $SD = 2.1$). Of the 68 participants, 28 (41.2%) reported low metaverse experience, indicating limited prior use of metaverse platforms despite having sufficient familiarity with the university's platform to participate in the study. Another 24 participants (35.3%) described themselves as moderate users who occasionally engaged with such environments, while 16 (23.5%) identified as highly experienced or expert users. In terms of academic year, 25 participants (36.8%) were first-year students, 27 (39.7%) were second-year students, and 16 (23.5%) were in

Table 1
Means and standard deviations of key variables.

Variable	M	SD
Emotional Engagement	4.18	.61
Social Presence	3.96	.70
Collective Identity	4.02	.67
Ritual Participation	4.20	.52
Avatar Synchrony	.72	.15
Spatial Proximity	.68	.19
Reconnection Intentions	4.05	.60

Table 2

Pearson correlations among study variables.

Variable	1	2	3	4	5	6	7
1. Emotional Engagement	—						
2. Social Presence	.56**	—					
3. Collective Identity	.61**	.59**	—				
4. Ritual Participation	.58**	.51**	.64**	—			
5. Avatar Synchrony	.13	.14	.09	.12	—		
6. Spatial Proximity	.10	.17	.07	.10	.62**	—	
7. Reconnection Intentions	.57**	.50**	.62**	.48**	.11	.08	—

Note. ** $p < .01$.

their third year or above.

Because only one participant identified as nonbinary, inferential analyses by gender were conducted for men and women only. As shown in Table 3, prior familiarity with metaverse environments was associated with differences in emotional engagement but not in collective identity. Specifically, participants with high metaverse experience reported greater emotional engagement ($M = 4.38$, $SD = .58$) than those with low experience ($M = 3.92$, $SD = .59$), $F(2, 65) = 4.92$, $p = .010$, $\eta^2 = .131$. By contrast, collective identity did not significantly differ across metaverse experience groups, $F(2, 65) = .64$, $p = .531$, $\eta^2 = .019$. No significant differences were observed by gender or academic year for either emotional engagement or collective identity.

5.4. RQ2: associated factors with collective identity

A multiple linear regression analysis examined whether ritual participation, emotional engagement, avatar synchrony, and spatial proximity were associated with collective identity. The model explained a significant proportion of variance in collective identity, $R^2 = .50$, adjusted $R^2 = .46$, $F(4, 63) = 15.48$, $p < .001$ (Table 4). Ritual participation showed the strongest positive association ($\beta = .46$, $p < .001$), and emotional engagement also showed a significant positive association ($\beta = .33$, $p < .001$). By contrast, avatar synchrony ($\beta = .09$, $p = .262$) and spatial proximity ($\beta = .07$, $p = .331$) were not statistically significant. These findings suggest that participants' subjective emotional and symbolic involvement was more closely associated with collective identity than visible behavioral coordination during the ritual. This pattern suggests that experiential factors were more closely associated with collective identity within virtual environments.

5.5. RQ3: indirect association

Further analysis examined whether collective identity functioned as an indirect linking variable between emotional engagement and reconnection intentions in an indirect association model. Results indicated a significant indirect association, such that emotional engagement was positively associated with collective identity ($b = .52$, $p < .001$), which in turn was positively associated with reconnection intentions ($b = .41$, $p < .001$). The bootstrapped indirect association ($b = .21$, 95% CI [.11, .32]) did not include zero, indicating a statistically significant conditional indirect pattern. The remaining direct association between emotional engagement and reconnection intentions also remained significant ($b = .26$, $p = .019$), suggesting that collective identity accounts for part, but not all, of their observed association. Collectively, this pattern suggests that collective identity was statistically implicated in an indirect association linking emotional engagement to continued participation in the virtual community.

5.6. RQ4: provisional dimensional pattern of VCC

An exploratory factor analysis (principal axis factoring with Promax rotation) was conducted to examine an indicative item-level factor

Table 3

Group differences in emotional engagement and collective identity.

Variable	Category	n	Emotional Engagement <i>M</i> (SD)	Test Statistic	p	η^2	Collective Identity <i>M</i> (SD)	Test Statistic	p	η^2
Gender	Male	38	4.15 (.60)	$t(65) = -.19$	.851	.001	4.05 (.65)	$t(65) = .36$	.719	.002
	Female	29	4.20 (.63)				3.99 (.69)			
Academic Year	First-year	25	4.14 (.62)	$F(2, 65) = .47$	.625	.014	4.00 (.67)	$F(2, 65) = .06$	.943	.002
	Second-year	27	4.19 (.61)				4.06 (.68)			
	Third year & above	16	4.22 (.58)				4.01 (.64)			
Metaverse Experience	Low	28	3.92 (.59)	$F(2, 65) = 4.92$	.010	.131	3.91 (.70)	$F(2, 65) = .64$	.531	.019
	Moderate	24	4.23 (.55)				4.08 (.64)			
	High	16	4.38 (.58)				4.12 (.69)			

Note. Gender comparisons were analyzed using independent-samples *t* tests and exclude the one participant who identified as nonbinary because a single case was insufficient for inferential comparison. Academic year and metaverse experience comparisons were analyzed using one-way ANOVA. η^2 is reported as an effect size estimate.

Table 4

Variables associated with collective identity.

Independent Variables	B	SE	β	<i>t</i>	<i>p</i>
Ritual Participation	.59	.12	.46	5.02	< .001
Emotional Engagement	.36	.10	.33	3.67	< .001
Avatar Synchrony	.40	.36	.09	1.13	.262
Spatial Proximity	.25	.25	.07	.98	.331

Note. Model fit: $R^2 = .50$, adjusted $R^2 = .46$, $F(4, 63) = 15.48$, $p < .001$. B = unstandardized coefficient; SE = standard error; β = standardized regression coefficient.

pattern for VCC. The data were suitable for factor analysis, as indicated by the Kaiser–Meyer–Olkin measure of sampling adequacy ($KMO = .86$) and Bartlett's test of sphericity, $\chi^2 = 412.57$, $p < .001$. An indicative two-factor pattern was retained based on eigenvalues greater than 1, scree plot inspection, and theoretical interpretability, accounting for 58.4% of the total variance. The first factor, labeled *Socio-Emotional Immersion*, comprised items related to emotional impact, perceived co-presence, and collective identity, suggesting that social presence was empirically intertwined with the affective and identificatory dimensions of VCC. The second factor, labeled *Symbolic Participation*, comprised items reflecting active ritual involvement and the perceived meaning of symbolic elements such as the sunset and fire-circle. Most retained items loaded above .40 on their primary factor, with limited cross-loading. Given the exploratory design and modest sample size, this structure should be interpreted as provisional rather than confirmatory. For interpretive clarity, Table 6 presents representative items with the strongest loadings. The full item pool used for the exploratory factor analysis is provided in Appendix C.

Table 5

Indirect association analysis summary.

Path	b	SE	<i>t</i>	<i>p</i>	95% CI
Emotional Engagement → Collective Identity (a)	.52	.09	5.78	< .001	—
Collective Identity → Reconnection Intentions (b)	.41	.08	5.13	< .001	—
Total Effect (c)	.47	.09	5.33	< .001	—
Direct Effect (c')	.26	.11	2.43	.019	—
Indirect Effect (ab)	.21	.05	—	—	[.11, .32]

Note. Indirect association was estimated using 5000 bootstrap samples. The indirect association was interpreted as statistically significant because the 95% confidence interval did not include zero. Given the cross-sectional design, these results are interpreted as associational rather than causal (see Table 5).

Table 6

Indicative item-level factor pattern from exploratory factor analysis.

Item	Socio-Emotional Immersion	Symbolic Participation
I felt emotionally moved during the event	.80	.30
I felt joy while participating in the ritual	.78	.28
I was emotionally invested in the collective experience	.76	.29
I felt the presence of others around me	.71	.25
I felt part of a meaningful group	.74	.33
I shared a common purpose with others in the event	.73	.36
I actively participated in the group ritual	.28	.76
The symbolic elements (e.g., sunset, fire-circle) were meaningful to me	.30	.79
I contributed to the group performance using emotes or gestures	.26	.74

Note. Items shown represent selected items with the highest primary loadings for interpretive clarity. Loadings were derived using principal axis factoring with Promax rotation. Given the exploratory design, modest sample size, and immediate post-ritual survey administration, this pattern should be interpreted as provisional and hypothesis-generating rather than as a validated latent structure. Only loadings of .40 or higher are interpreted as salient.

6. Discussion

This study examined how VCC emerges, takes form, and relates to social outcomes through symbolic ritual participation in a metaverse environment. Participants reported relatively high levels of emotional engagement, ritual participation, collective identity, and intentions to reconnect with the virtual community. Behavioral indicators such as avatar synchrony and spatial proximity were not significant predictors of collective identity. By contrast, collective identity was strongly associated with ritual participation and intentions for future engagement. The indirect association analysis further showed that collective identity occupied a statistically meaningful position in the relationship between emotional engagement and reconnection intentions. This finding suggests that shared emotional experiences during virtual rituals may be linked to stronger perceived attachment to the virtual community. Moreover, socio-emotional immersion and symbolic participation emerged as two underlying dimensions of VCC. These dimensions reflect participants' affective resonance and psychological presence during the event, along with their engagement in ritualized meaning-making activities. The findings offer a bounded contribution to sociological theory by extending classical and contemporary frameworks to a specific context of digital interaction. Rather than claiming that the observed dynamics are unique to metaverse environments, the study clarifies how ritual-like events in one metaverse setting may be associated with collective identification and perceived social continuity in the absence of physical co-presence. In this regard, the discussion should be read as an

analytically focused account of mediated ritual processes rather than a comparative test of how metaverse environments differ from other digitally mediated collective contexts.

6.1. Platform familiarity and affective readiness (RQ1)

Prior familiarity with metaverse environments was associated with emotional engagement, although this association did not extend to collective identity formation. This pattern challenges the assumption that platform familiarity or technical fluency necessarily produces stronger social belonging in virtual environments. It also highlights a differentiation between technical immersion and social integration. Participants who were more familiar with virtual environments may have been more affectively attuned to the sensory and aesthetic features of the ritual because prior experience reduced cognitive friction and increased perceptual fluency within immersive spaces (Garcia, 2025). However, affective readiness did not automatically translate into a stronger sense of shared belonging or moral unity. Recent research on metaverse adoption and learning supports this distinction. Arghashi and Gunalay (2025) found that metaverse familiarity among young users enhanced emotional motivation and self-extension, although it did not consistently predict sustained identity-based engagement. Wenzel et al. (2025) similarly found that increased realism and familiarity in 3D metaverse-based learning elevated affective and social experience without necessarily strengthening learning identity or belonging. These findings converge with Koziel et al. (2025), whose work on psychological and hedonic drivers of metaverse adoption showed that self-efficacy and perceived enjoyment contribute to continued engagement. In educational settings, Li and Yu (2023) likewise observed that engagement in metaverse-based blended learning depends on digital literacy and user comfort, while collective belonging requires social construction through interaction and shared meaning-making.

From a sociological perspective, this pattern suggests that symbolic meaning in virtual communities must be socially constructed rather than technologically afforded. Technical fluency may amplify immersion and emotional presence by lowering interface-related cognitive load (Dwivedi et al., 2024; Vakeel et al., 2025; Wenzel et al., 2025), yet the transformation of shared emotion into solidarity still depends on collective negotiation of meaning, ritual symbolism, and moral framing. As Durkheim's (1912) and Castells' (2009) frameworks suggest, emotional arousal becomes socially integrative when it is mediated by symbols and interpretive coherence. Thus, metaverse literacy may increase the affective bandwidth of interaction, but it does not replace the social labor of meaning-making that sustains CC. Furthermore, the absence of significant gender and academic-level differences further suggests that affective engagement and emergent VCC may operate similarly across these demographic categories in the present context. This finding aligns with Li and Yu's (2023) argument that immersive digital environments can facilitate more egalitarian affective participation when digital literacy thresholds are met. However, it should not be interpreted as evidence that identity formation is demographically neutral across all virtual contexts. Prior work on group consciousness indicates that social location can shape how individuals interpret collective belonging, especially when group identity is connected to recognition, exclusion, or shared social experience (Austin et al., 2012). In this sense, platform familiarity may broaden access to emotional resonance within virtual rituals, while the emergence of shared identity and solidarity still depends on symbolic participation and social reflection (Beltramini, 2025). Consequently, VCC appears as a two-tiered process: *affective readiness* conditioned by familiarity and *collective identity* constituted through shared symbolic construction.

6.2. Rituals and emotion drive identity more than visibility (RQ2)

Emotional engagement and ritual participation showed the strongest associations with collective identity in the virtual ritual. Participants

who reported greater emotional intensity and more active symbolic involvement also reported stronger identification with the group. This finding supports Durkheim, 1912 proposition that shared affect and symbolic enactment are central to collective life. By contrast, visible behavioral indicators such as avatar synchrony and spatial proximity were not significantly associated with collective identity. This pattern does not diminish the analytical relevance of the metaverse. Instead, it specifies where that relevance may be found. The findings suggest that collective identity in this platform was shaped less by observable coordination at the avatar level and more by the platform's capacity to organize mediated co-presence, shared symbolic focus, and temporally coordinated participation without physical assembly (Sprott et al., 2025). The metaverse is analytically central because it structures the conditions through which ritual participation becomes emotionally salient and socially interpretable, rather than because its visible surface mechanics directly predict identity. This result is noteworthy because behavioral synchrony and physical alignment are often treated as foundational conditions of collective bonding in classical ritual theory and contemporary immersive media research (Biocca et al., 2003; Slater & Sanchez-Vives, 2016).

As recent studies on digital and livestreamed rituals affirm, collective effervescence in mediated settings depends less on physical alignment and more on shared emotional arousal and symbolic resonance (Henry, 2024; Vandenberg & Berghman, 2024). This shift reflects a broader reconceptualization of co-presence in digital environments, where affective attunement can become a primary mechanism through which group cohesion is experienced. Emotional convergence, whether expressed through avatars, chat messages, or virtual gestures, can generate a sense of co-presence that sustains group meaning (Campos-Castillo & Hitlin, 2013). Recent metaverse and social VR research further suggests that interaction frequency and platform familiarity may enhance perceived presence and engagement, yet they do not inherently produce deeper forms of collective identification without emotionally charged participation (Raman et al., 2025; Xu, 2023). Work on online interaction rituals reinforces this interpretation by showing that mediated encounters may reproduce key ritual processes when they provide recognizable symbolic participation, mutual focus, and shared emotion (Mizrahi-Werner et al., 2024). Affect, in this sense, operates as a socially distributed process that aligns participants within a common interpretive and emotional horizon. The virtual ritual therefore functioned less as a coordinated performance than as a symbolic encounter that gathered participants around a shared affective frame. Meaning emerged through the circulation and amplification of emotional cues, rather than through visible behavioral synchrony alone.

This emphasis on emotional and symbolic participation aligns with emerging work on digital rituals and mediated collective events, which highlights affective resonance as central to communal meaning. Henry (2024) conceptualizes digital ritual as a continuum of symbolically charged encounters capable of evoking authentic interaction and solidarity across mediated boundaries. Vandenberg and Berghman (2024) describe hyper-ritualization in livestreamed concerts, where audiences without bodily synchrony reaffirm belonging through symbolic gestures and textual expressions of emotion. Similar processes appear in religious and activist contexts, where affective intensity rather than physical proximity predicts collective mobilization (Gledhill et al., 2022; Tran & Davies, 2023). In the present study, this pattern suggests that VCC emerges through emotional contagion and ritual symbolism that frame the experience as collectively meaningful. In Durkheimian terms, the moral force of the group resides less in visible alignment than in shared emotional energy transformed into symbolic form. The metaverse extends the ritual field by providing spaces that may lack material synchrony while retaining the capacity to cultivate solidarity through the orchestration of collective imagination.

6.3. Identity as a gateway to community commitment (RQ3)

Moments of shared emotion may coincide with unity, but the present findings suggest that collective identity is more closely aligned with participants' intentions for continued community involvement. Collective identity occupied a meaningful position in the indirect association linking emotional engagement and future social intentions. Emotional arousal was salient to participants' experience of the virtual ritual, yet stronger reconnection intentions were more closely associated with whether participants felt part of a meaningful group. This pattern suggests that emotional engagement may mark an initial dimension of collective experience, while collective identity helps explain how affective energy becomes connected to future involvement. Recent metaverse research supports this distinction while also clarifying its limits. Kim et al. (2025), for instance, showed that social identity directly predicted intention in metaverse contexts and operated through user engagement. By contrast, Tao et al. (2025) found that immersiveness and environmental fidelity shaped continuance intention through consumer experience, while sociability emerged as the strongest driver of continued use. These studies suggest that immersive affect and atmospheric intensity may draw users into the moment, but they do not fully explain why users orient themselves toward a future with the group. This interpretation is consistent with social identity perspectives, which argue that behavior becomes group-directed when individuals define themselves in relation to a meaningful collective rather than merely respond to an emotionally stimulating situation (Tajfel & Turner, 2004).

In metaverse contexts, users may experience powerful emotions through immersive aesthetics. Those emotions appear more closely aligned with sustained interaction when they are symbolically linked to a shared sense of "we." Yang et al. (2025) reinforce this interpretation by conceptualizing metaverse identity as a multidimensional construct that fuses emotional presence with social and economic roles, allowing digital selves to extend beyond momentary encounters into relational continuity. This indirect pattern underscores the interpretive role of identity in digital community formation. Emotional engagement may support initial immersion, but stronger future-oriented belonging depends on a shared framework that places the individual within the collective. Studies of online and virtual teams have shown that salient group identity is associated with stronger cohesion, performance, and prosocial intentions (Roodt et al., 2021). Katachie and Kessler (2024) similarly trace the metaverse's social imaginary to its promise of identity reconstruction within communal visions of technological futures, suggesting that digital belonging carries sociocultural as well as affective weight. Evidence from adjacent virtual settings supports this mechanism. In virtual brand communities, Li et al. (2026) found that social presence positively influenced continuous participation intention through brand identity and community identity in a chain-mediating process. These findings suggest that immediate experiences of co-presence become socially meaningful when interpreted through collective identification.

At the same time, recent studies caution against a singular account of identity. Di Natale et al. (2024) and Garcia (2025) show that continuance intention in immersive virtual reality and metaverse-integrated learning environments is also shaped by expectation confirmation and perceived usefulness. Naureen and Faiz (2026) further demonstrate that gamer-avatar identification significantly influences continuance usage intention in virtual reality contexts. Continuity in virtual environments may therefore be anchored in multiple forms of attachment, including identification with a collective, identification with an avatarized self, and evaluations of experiential or instrumental value. The present findings should therefore be understood as showing that collective identity served as the more proximate interpretive link through which emotional engagement became socially durable in the ritual setting examined here. From a sociological standpoint, this progression reflects the movement from collective effervescence to collective consciousness in Durkheimian terms, where shared symbols stabilize the emotional

energy of the group into moral and social order. The metaverse ritual appears to provide a symbolic framework within which affective experience, belonging, and intentions for continued participation become meaningfully aligned within emergent virtual communities.

6.4. Virtual collective consciousness as a two-factor structure (RQ4)

The emergence of VCC as a two-factor structure suggests that collective experience in the metaverse is both affectively experienced and symbolically interpreted. Exploratory factor analysis indicated that socio-emotional immersion and symbolic participation jointly articulate how participants experience and construct collective meaning in virtual rituals. Socio-emotional immersion captures affective resonance, psychological absorption, and embodied co-presence within immersive settings. This dimension aligns with the view that presence and embodiment function as foundational affordances of immersive environments (Dincelli & Yayla, 2022; Raman et al., 2025). Spratt et al. (2025) describe this phenomenon as *phygital social presence*, where avatars' human and automated social cues evoke emotional connection and perceived intimacy. Jin, 2024 similarly shows how avatar self-representation can amplify psychological involvement by extending the user's sense of self into the virtual world. Di Natale et al. (2024) further demonstrate that metaverse environments can enhance affective engagement through presence-driven experiences that shape satisfaction and continued participation. These studies support the interpretation of socio-emotional immersion as an experiential substrate of VCC. It captures the affective energy through which users feel together even in digitally mediated spaces. However, the present two-factor pattern also suggests that presence alone is not equivalent to VCC. Presence may make the social environment feel perceptually real, while symbolic participation appears necessary for perceptual realism to become collectively meaningful.

Symbolic participation complements this dimension by capturing users' engagement in ritualized actions and meaning-making practices. These include shared gestures, emotes, and symbolic artifacts that frame emotional arousal within a coherent social narrative. This process mirrors Laato et al.'s (2023) finding that religious and gaming experiences converge through systems of shared symbolism and collective orientation, suggesting that virtual rituals can function as techno-spiritual events in which emotional resonance is socially codified. Extending this perspective, symbolic participation contributes to digital selfhood within collective contexts, as users construct and negotiate meaning through socially recognized practices embedded in virtual environments. Emerging research on virtual communities further indicates that symbolic interactions can transform transient experiences into structured forms of belonging by allowing participants to interpret their actions as part of a shared cultural script (e.g., Adria, 2024; Buana, 2023; Li et al., 2026). This interpretation converges with studies of mediated rituals showing that synchronized comments, symbolic cues, shared focal objects, and platform-enabled interaction can convert dispersed individual responses into recognizable forms of collective attachment (Henry, 2024; Vandenberg & Berghman, 2024). In this sense, symbolic participation functions as the interpretive layer through which affective immersion is stabilized, allowing individuals to situate themselves within a collective narrative beyond the immediacy of the virtual encounter.

The two-dimensional structure further indicates that belonging in virtual rituals is inherently affective rather than purely cognitive. The convergence of emotional and identity indicators in the factor model supports the proposition that collective identification emerges through emotional synchronization and symbolic affirmation. Jin, 2024 work on avatar self-verification and the Proteus effect illustrates how users negotiate authenticity and aspiration through emotionally charged digital identities, while Spratt et al. (2025) highlight how affective and relational cues embedded in avatars' design mediate users' sense of social presence. Raman et al. (2025) likewise find that in immersive

metaverse environments, cognitive, emotional, and social mechanisms interact reciprocally to sustain engagement and trust. These patterns parallel Durkheim, 1912 and Turner et al., 1969 classical accounts of ritual solidarity, in which emotion and symbol jointly generate moral unity. Yet, as Laato et al. (2023) observe, the metaverse reconfigures these processes through technological mediation, transforming sacred co-presence into symbolic interactivity. The two-factor model of VCC thus extends ritual theory into digital terrains, aligning with interaction ritual theory (Collins, 2004) and reinforcing the coupling of affective and symbolic processes observed in virtual rituals. It suggests that the metaverse may reproduce aspects of the sociological logic of face-to-face ceremonies, where shared emotion is closely intertwined with symbolic coherence and symbolic participation.

6.5. Analytical extensions of Durkheimian ritual theory in virtual contexts

This study contributes to the sociology of ritual by examining how core Durkheimian processes associated with collective effervescence may be interpreted within technologically mediated environments. The extension of Durkheimian ritual theory to the metaverse should be understood as an analytical rather than a literal transposition of classical constructs. In Durkheim's formulation, collective effervescence emerges through shared arousal, moral elevation, and symbolic reorientation toward a sacred object. These processes are typically understood through embodied co-presence and overt behavioral synchrony. In the present study, they cannot be observed in their classical form because interaction was mediated and the analysis relied partly on self-report measures. Instead, they were operationalized through empirically accessible indicators that captured participants' experienced alignment with the collective.

Self-reported emotional engagement reflected perceived shared arousal. Ritual participation indexed symbolic enactment and attentional convergence. Collective identity captured moral and identificatory reorientation toward the group as a meaningful social whole. While these indicators do not constitute direct observation of collective effervescence, their patterned relationships suggest that core Durkheimian processes may be experientially reflected under conditions of technological mediation. Physiological research on ritual similarly shows that collective rituals can generate shared arousal patterns among participants and spectators, indicating that affective alignment can be empirically traced across different forms of ritual participation (Xygalatas et al., 2011). The findings therefore speak to the functional continuity of ritual dynamics, without claiming phenomenological equivalence with face-to-face ritual settings.

A further boundary concerns the type of claim this study can validly make about the metaverse. The patterns identified here should not be read as evidence that the metaverse generates wholly novel social processes detached from offline collective life. Nor do they imply that specific platform mechanics must directly predict collective identity for the metaverse to matter analytically. The findings instead show how familiar sociological processes, including emotional convergence, symbolic participation, and the formation of collective identity, are reconfigured when enacted through avatar mediation, constrained embodiment, platform-orchestrated attention, and the absence of corporeal co-presence. Under these conditions, the metaverse operates as the infrastructural form through which ritual participation is assembled, paced, and rendered socially intelligible. Accordingly, the findings are best understood as analytically generalizable at the level of process reconfiguration rather than as empirically universal across all virtual or offline settings. The study therefore does not claim that the metaverse is necessary because its visible mechanics independently drive identity formation. Rather, it claims that the metaverse is central to the present analysis because it specifies a mediated configuration in which CC is enacted and interpreted.

A related interpretive issue concerns the political and infrastructural conditions within which metaverse rituals unfold. The present study did

not directly measure platform governance, algorithmic steering, monetization practices, or data extraction. It therefore cannot make empirical claims about how these forces shaped participants' experiences during the event. Even so, the findings should not be interpreted as if ritualized digital participation occurs in a socially neutral environment. From a science and technology studies perspective, metaverse rituals are embedded within sociotechnical infrastructures whose design, governance, and economic imperatives condition the forms of interaction that become possible, visible, and sustainable (Liu & Gómez-Cruz, 2025). Critical scholarship on platform capitalism further suggests that affective engagement and collective attachment may be cultivated within systems shaped by commodification, data capture, and asymmetries of control (Ak, 2025; Spier, 2025; Zuboff, 2019). Accordingly, these considerations are best understood as structural boundary conditions that frame the interpretation of the findings. Recognizing these conditions does not diminish the sociological significance of digitally mediated rituals but clarifies that collective meaning is formed within broader infrastructures of governance and value capture.

6.6. Implications for design, education, and organizational practice

The findings offer provisional implications for how metaverse environments may be designed and interpreted as sites of collective experience. Because the study examined a single ritual event within one exploratory context, these implications should be understood as analytically suggestive rather than prescriptive. Within these limits, the results indicate that emotional engagement, symbolic participation, and collective identity may be more consequential for participants' sense of communal attachment than visible behavioral coordination alone. The discussion below therefore focuses on implications closely aligned with the empirical scope of the study, while treating broader applications as tentative directions for future research.

6.6.1. Metaverse and platform design

For designers and developers, the results suggest the value of shifting attention from purely technical or behavioral metrics of social interaction toward affective and symbolic affordances that scaffold shared meaning. While prior design research has often prioritized realism, embodiment, and spatial fidelity as pathways for enhancing social presence (Dincelli & Yayla, 2022; Dwivedi et al., 2024), the present findings suggest that emotional resonance and ritual framing may be more closely associated with collective identity and long-term engagement. Designing for VCC therefore involves curating collective emotional trajectories through shared symbolic moments that frame participation as a meaningful communal event rather than a series of individual interactions. Recent design science research supports this approach, showing that emotionally salient transitions and shared focal symbols enhance perceived social value and community attachment in immersive environments (Gandhi et al., 2024; Raman et al., 2025). Features such as shared countdowns, collective attention toward symbolic artifacts, and ritualized closing sequences may function as digital equivalents of ceremonial markers that stabilize affective energy into collective meaning.

The findings also caution against overreliance on granular behavioral data as proxies for social cohesion. Although avatar synchrony and spatial proximity are often treated as indicators of engagement, they were not significantly associated with collective identity in this study. This pattern aligns with recent evidence suggesting that affective alignment and interpretive coherence are central to social bonding in mediated environments (Vandenberg & Berghman, 2024). Designers seeking to cultivate VCC should therefore prioritize symbolic coherence, emotional pacing, and shared interpretive frames over increasingly complex behavioral features.

6.6.2. Education and learning communities

The educational implications of these findings are especially salient.

A robust sense of belonging has consistently been identified as one of the strongest factors associated with student motivation, persistence, and academic success (Davis et al., 2019; Pedler et al., 2022). The present study suggests that metaverse-based learning environments may contribute to this sense of belonging when they move beyond instrumental instructional design and incorporate ritualized collective experiences. Educational metaverses may benefit from integrating symbolic gatherings such as virtual commencements, cohort milestones, reflective closing rituals, and shared celebratory events that reinforce collective identity alongside academic participation. Recent studies in metaverse-supported education show that emotionally immersive and symbolically framed experiences can enhance learners' social integration and perceived community, even when cognitive outcomes remain unchanged (Lampropoulos et al., 2025; Li & Yu, 2023). These findings align with the present results, which indicate an indirect association involving collective identity in the relationship between emotional engagement and intentions to reconnect.

These implications are especially relevant for students who are structurally or socially marginalized, including first-generation college students, students with disabilities, international students, and members of racial, ethnic, or sexual minority groups. Research has shown that digitally mediated environments can serve as compensatory spaces of belonging when designed to support inclusive symbolic participation and affective affirmation. However, the availability of immersive space does not automatically produce inclusion (Park & Kim, 2025). If symbolic scripts, avatar norms, or interaction rituals reproduce existing hierarchies, the metaverse may amplify exclusion as easily as it can foster belonging. Thoughtfully designed metaverse-based rituals may therefore function as institutional glue that supports attachment and solidarity under conditions of physical distance, social fragmentation, or unequal access to on-campus community.

6.6.3. Organizational, civic, and therapeutic practice

Although the present study did not directly examine organizational or therapeutic contexts, the findings raise tentative questions for these domains. As remote work, distributed organizations, and digitally mediated communities become increasingly normalized, maintaining shared identity and social cohesion presents a growing challenge. This study suggests that ritualized virtual gatherings may support organizational commitment and collective morale. Recent research on remote and hybrid work in the metaverse indicates that emotionally engaging social experiences are significantly associated with job satisfaction and perceived organizational support, sometimes more strongly than task-related collaboration tools (Vakeel et al., 2025). Symbolic rituals such as onboarding ceremonies and shared commemorative events may help organizations connect episodic digital interaction to a broader collective orientation.

In therapeutic and psychosocial domains, the implications are also worth considering. Emerging studies suggest that metaverse-based interventions and other metaverse-mediated social experiences can foster emotional support, resilience, and solidarity among individuals experiencing isolation, trauma, or chronic illness (Hasei et al., 2024; Park & Kim, 2025; Yadav et al., 2024). The present findings suggest that the efficacy of such interventions may depend less on heightened embodiment alone and more on the symbolic framing of shared emotional experience. When participants perceive themselves as part of a meaningful collective, ritualized virtual encounters may serve as emotionally safe and socially integrative spaces for healing and mutual support. However, these extensions remain speculative and were not directly tested in the present study and therefore require independent empirical verification before informing practice.

6.7. Toward a design ethos of virtual collective consciousness

Collectively, these implications point toward a broader design orientation centered on VCC. Rather than conceiving the metaverse

primarily as a site of interaction, simulation, or experiential novelty, this study advances the view of the metaverse as a ritual infrastructure or a sociotechnical arrangement that organizes how participants enter a shared event, orient themselves toward symbolic focal points, experience mediated co-presence, and interpret their involvement as part of a larger "we." Within this framework, the analytical importance of the metaverse does not reside solely in isolated features such as avatar movement or proximity, but in the broader configuration through which participation is staged, paced, and made meaningful.

Designing for VCC therefore requires more than enhancing immersion or increasing opportunities for interaction. It requires deliberate attention to affective attunement, symbolic coherence, and identity formation. These processes are sociological in nature, although they are scaffolded by platform architectures that shape how collective experience can be assembled under technological mediation. Framed in this way, the metaverse is not simply an interactive environment. It is a structured space for producing shared meaning, within which belonging, solidarity, and sustained collective orientation can emerge. Such a design ethos shifts attention from how realistic a virtual world feels to how its rituals, symbols, rhythms, and governance structures help participants experience themselves as part of a meaningful collective.

6.8. Limitations and future directions

Several limitations should be considered when interpreting these findings. First, although the study analyzed both self-reported and behavioral data from the metaverse environment, its cross-sectional design limits the ability to establish causal relationships among emotional engagement, ritual participation, and collective identity. Because the self-report measures were administered in the same immediate post-ritual survey, shared timing and response context may also have strengthened correlations among the constructs. This issue should be considered when interpreting the regression estimates and the exploratory factor structure. Longitudinal or repeated-measures designs would allow future studies to track participants over time and provide a clearer account of how emotional engagement, ritual participation, and collective identity develop, stabilize, or weaken beyond a single event. Such approaches would also offer stronger insight into the durability of emotional and symbolic bonds formed through virtual rituals. Experience sampling, repeated post-event surveys, and longitudinal network analysis could clarify whether VCC persists as a durable orientation or dissipates once the ritual moment ends.

A second limitation concerns the specificity of the context examined. Because the study focused on a single group participating in one symbolic event within one metaverse platform, it cannot determine whether the observed processes are distinctive to metaverse environments or whether similar forms of collective orientation would emerge in other digitally mediated settings, such as livestreamed events, online communities, or non-immersive virtual gatherings. Accordingly, the study is better understood as an examination of the metaverse as one socio-technical configuration of mediated ritual participation, rather than as a basis for broad comparative claims about the digital ecology of collective life. Future research would benefit from comparative, multi-event, and multi-platform designs that identify which aspects of immersive environments meaningfully differentiate metaverse-based rituals from other forms of digitally mediated collective experience. Examining contrasting ritual forms, such as virtual protests, memorial vigils, or celebratory events, may also clarify how different symbolic settings generate distinct emotional trajectories, participation patterns, and pathways of VCC.

A related limitation arises from the use of a single metaverse platform, which restricts the ability to isolate the technological affordances most relevant to the observed collective dynamics. Features such as avatar realism, interactivity, spatial configuration, and system feedback may shape the emergence and sustainability of VCC in different ways,

but these effects cannot be disentangled within the present design. Comparative platform studies are needed to examine how varying affordances influence collective experience across gaming-based platforms, workplace metaverses, and social VR environments. Such work would help clarify how design features interact with user behavior and group dynamics to produce emergent forms of digital collectivity.

The contextual boundedness of the sample also warrants consideration. The findings reflect a specific institutional, cultural, and technological environment, and participants were recruited from a limited number of university courses. Some observed demographic differences may therefore partly reflect recruitment clustering rather than purely individual-level variation. In addition, reliance on a university student sample limits the generalizability of the findings, as individuals from different age groups, cultural contexts, and social backgrounds may engage with metaverse rituals in different ways. Broadening recruitment beyond university-based populations would allow future studies to examine whether the present findings generalize across diverse social groups or remain contingent on particular contexts. This is especially important because populations shaped by exclusion, marginalization, or heightened social awareness may exhibit distinct patterns of virtual solidarity and identity expression (Austin et al., 2012). Cross-cultural research would be especially useful, given that ritual symbols, emotional expression, and collective identity may be interpreted differently across societies and institutional settings.

Finally, the behavioral analysis was confined to visible avatar actions and spatial dynamics. This may have overlooked subtler forms of interaction, including linguistic nuance, text-based communication, vocal tone, and other embodied or affective signals that contribute to collective meaning-making. Although the integration of behavioral and self-reported data provided a broader perspective than reliance on a single data source, it still captured only part of the interpersonal dynamics through which virtual connection is formed. Future studies should expand the analytic frame to include multimodal evidence such as voice data, discourse analysis, chat interaction, and physiological indicators, including heart rate variability or galvanic skin response. These approaches would provide a more complete understanding of the affective and communicative processes underlying collective identity formation. Advancing research in this direction would further strengthen the study of VCC as a distinct sociotechnical phenomenon.

7. Conclusion

Communities in virtual worlds show how collective life persists and transforms under conditions of technological mediation. In the

metaverse, social connection is sustained through shared affect, symbolic participation, and mediated forms of co-presence associated with VCC. The present study found that emotional engagement and ritual participation were strongly associated with collective identity, while visible coordination, such as avatar synchrony and spatial proximity, had comparatively limited influence. These findings reinforce the view that solidarity in virtual environments is grounded more strongly in affective and symbolic processes than in behavioral alignment alone. Through the convergence of collective effervescence and networked sociality, participants in the virtual ritual reported a sense of belonging and intentions to reconnect beyond the event. The emergence of socio-emotional immersion and symbolic participation as dual components of VCC further suggests that digital communities are affectively lived and symbolically constructed. In this regard, the metaverse may be understood as a sociotechnical arena where emotional energy can be transformed into moral and symbolic integration, extending Durkheimian and Castellsian insights into contemporary digital culture. Overall, the findings suggest that even without physical embodiment, the metaverse can serve as a context in which reported forms of collective orientation and social meaning may emerge. Virtual rituals thus demonstrate that solidarity in the digital age is not a diminished echo of face-to-face community, but an evolving configuration of shared emotion, symbolic coherence, and mediated co-presence through which new forms of CC are constituted.

CRedit authorship contribution statement

Manuel B. Garcia: Conceptualization, Formal analysis, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. **Sou Hyun Jang:** Validation, Writing – original draft, Writing – review & editing.

Compliance with ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Metaverse Ritual Procedure

This appendix documents the procedural design of the metaverse-based ritual event. It provides details that were not fully elaborated in the main Methods section, including the ritual timeline, facilitator actions, participant actions, symbolic purpose of each phase, behavioral data captured, platform constraints, affective pacing controls, and contingency protocols. It is intended to make the experimental procedure transparent and replicable for readers. The ritual was designed as a bounded symbolic event rather than an open-ended virtual gathering. Its structure was informed by the study's focus on ritualized participation, avatar-mediated coordination, and collective identity formation. Across sessions, the same sequence, timing, prompts, focal points, and closure procedures were used to maintain procedural consistency.

Metaverse Ritual Procedure, Event Script, and Experimental Controls

The metaverse-based ritual followed a standardized 20-min sequence designed to simulate a temporally bounded, symbolically organized, and emotionally paced collective experience. The sequence was structured to move participants from individual platform entry toward shared attention, coordinated symbolic action, affective climax, and collective closure. Table B1 presents the full ritual event script and experimental timeline.

Table A1
Full Ritual Event Script and Experimental Timeline

Time Marker	Ritual Phase	Facilitator Action	Participant Action	Symbolic or Experimental Function	Data Captured
0:00–2:00	Entry and Orientation	The facilitator avatar welcomed participants at the designated beach gathering area and instructed them to move toward the central meeting point. Basic reminders were given regarding movement, emotes, and participation expectations.	Participants entered the metaverse environment, navigated toward the central area, and positioned their avatars near the group.	Established the ritual boundary and marked the transition from individual platform entry to collective participation.	Initial avatar positioning, movement toward the group, and early proximity patterns.
2:00–4:00	Group Assembly and Shared Attention	The facilitator asked participants to gather near the central area and face the designated focal point. Participants were reminded that the activity would proceed as a shared group experience.	Participants positioned their avatars within the designated group space and oriented toward the facilitator or shared focal area.	Created a common attentional frame and prepared participants for coordinated symbolic action.	Spatial proximity, attentional orientation, and readiness for coordinated activity.
4:00–5:00	Collective Countdown	The facilitator initiated a group countdown using text prompts and avatar gestures.	Participants followed the countdown and prepared to perform the first synchronized emote.	Marked a collective entry point into the ritual proper and created temporal synchronization.	Avatar responsiveness and participation during the countdown.
5:00–8:00	Synchronized Emote Sequence	The facilitator prompted participants to perform a sequence of pre-programmed emotes, such as waving, cheering, or celebratory gestures.	Participants activated the requested emotes during the designated time window.	Encouraged visible coordination and performative alignment among avatars.	Avatar synchrony, emote timing, and participation consistency.
8:00–12:00	Choreographed Group Movement	The facilitator guided participants through a simple group movement or dance sequence using available avatar gestures and movement controls.	Participants followed the sequence by moving, dancing, or performing gestures with the group.	Supported collective rhythm, shared embodiment, and visible group performance within the limits of the platform.	Avatar synchrony, movement coordination, and deviations from the group sequence.
12:00–14:00	Transition to Symbolic Focal Point	The facilitator directed participants to move toward the sunset-viewing area and face the virtual horizon.	Participants moved toward the designated viewing area and oriented their avatars toward the sunset.	Shifted the event from performative coordination to symbolic contemplation and shared attention.	Spatial proximity, group movement, and orientation toward the focal symbol.
14:00–17:00	Sunset-Watching Moment	The facilitator invited participants to remain still, face the virtual sunset, and experience the moment as a shared symbolic pause.	Participants remained near the group and faced the sunset. Some used quiet gestures or remained stationary.	Served as the emotional and symbolic climax of the ritual by creating a shared moment of reflection and affective focus.	Proximity, stillness, attentional orientation, and visible participation during the symbolic climax.
17:00–19:00	Fire-Circle Gathering	The facilitator guided participants to the virtual fire-circle and invited them to gather around it.	Participants moved toward the fire-circle and positioned themselves around the shared symbolic object.	Created a closing ritual space and reinforced group belonging through circular spatial arrangement.	Proximity around the fire-circle, clustering behavior, and participation in closing formation.
19:00–20:00	Collective Closure	The facilitator delivered a short closing message thanking participants and signaling the end of the shared ritual. Participants were then directed to proceed to the post-event questionnaire.	Participants remained in the fire-circle area until the closing prompt and then exited or proceeded to the survey.	Marked the ritual ending and transitioned participants from collective experience to individual reflection.	Final proximity patterns and completion of the ritual sequence.

The same ritual sequence was used across all sessions to maintain procedural consistency. Facilitator prompts were standardized to reduce variation in pacing, emotional framing, and participant instruction. The event was intentionally designed as a short ritual sequence rather than an open-ended metaverse gathering. This design allowed the study to examine how emotional engagement, ritual participation, avatar synchrony, spatial proximity, and collective identity were associated within a bounded symbolic experience.

The ritual sequence followed five experimental principles. First, the entry and orientation phase established a boundary between ordinary platform access and ritual participation. Second, group assembly and countdown activities created shared attention and temporal synchronization. Third, synchronized emotes and choreographed movement operationalized visible coordination. Fourth, the sunset-watching moment functioned as the symbolic and affective climax of the experience. Fifth, the fire-circle gathering provided ritual closure through spatial convergence around a shared symbolic object.

Key Procedural Design Decisions and Methodological Rationale

Several procedural decisions were made to isolate collective experience from individual-level variability and technological confounds. These decisions were intended to ensure that observed responses were more closely linked to the ritual sequence itself rather than to uncontrolled differences in communication channels, exposure duration, or facilitator behavior.

Table A2
Procedural Design Decisions and Rationale

Design Decision	Procedural Implementation	Methodological Rationale
Limited avatar customization	Participants used standardized avatar templates with only basic adjustable features.	Reduced the salience of individual identity cues and redirected attention toward collective participation rather than self-presentation.
Voice communication disabled	Audio channels were disabled during the ritual event.	Prevented dominance effects, uneven emotional influence, and differences in verbal participation across participants.

(continued on next page)

Table A2 (continued)

Design Decision	Procedural Implementation	Methodological Rationale
Fixed ritual duration	The ritual sequence lasted approximately 20 min.	Ensured comparable affective exposure across participants and minimized fatigue.
Standardized phase transitions	The facilitator followed the same sequence of prompts and transitions across sessions.	Reduced facilitator-induced variance and helped maintain consistent pacing across sessions.
Collective visual focal points	The sunset and fire-circle served as shared symbolic objects.	Anchored shared attention, symbolic alignment, and collective interpretation.
Desktop/laptop access only	Participants accessed the platform using desktop or laptop computers.	Reduced variability in navigation, screen display, and behavioral recording compared with mobile access.
Group-level instructions	The facilitator used group-level prompts rather than individualized correction.	Preserved the collective flow of the ritual and avoided drawing attention to individual deviations.

Constrained Platform Affordances and Default Behaviors

Several platform features were technically available but deliberately constrained during the ritual to preserve procedural uniformity. These constraints helped ensure that the ritual sequence was experienced in a comparable way across sessions. Importantly, they did not remove the natural variation in participant behavior. Instead, they limited avoidable sources of procedural inconsistency while preserving the socially interactive nature of the metaverse experience.

Table A3

Disabled or Constrained Platform Features

Feature	Default Capability	Constraint Applied	Purpose of Constraint
Camera zoom	Free zoom	Viewing distance was kept consistent across participants as much as possible.	Reduced variation in visual perspective and focal attention.
Avatar collision	Enabled	Disabled during the ritual.	Prevented physical obstruction or crowding effects that could interfere with group movement.
Gesture cancellation	Enabled	Participants were instructed not to cancel emotes mid-sequence unless technically necessary.	Preserved the integrity of synchronized emote sequences.
Environmental triggers	Interactive	Non-essential triggers were disabled or avoided during the ritual.	Prevented distractions from the symbolic sequence.
Chat persistence	Persistent	Chat content was not treated as part of the main behavioral coding record.	Kept the behavioral analysis focused on visible avatar actions and spatial positioning.
Voice communication	Available in principle	Disabled during the ritual.	Ensured that affective engagement was not disproportionately shaped by verbal interaction.

Temporal and Affective Pacing Controls

Affective pacing was treated as a controlled procedural element rather than an entirely emergent outcome. These pacing controls were used to ensure that emotional engagement was not driven primarily by prolonged exposure, novelty spikes, or uneven participation timing. The ritual was structured to move from neutral entry to rising arousal, then to symbolic consolidation and closure. The pacing sequence was designed to support a ritual arc. Early phases prepared participants for shared action, middle phases encouraged visible participation and coordination, and later phases directed attention toward symbolic reflection and closure. This structure allowed the study to examine both performative and symbolic dimensions of virtual collective experience.

Table A4

Affective and Temporal Pacing Controls

Ritual Phase	Emotional Target	Duration Constraint	Control Mechanism
Entry and Orientation	Neutral orientation	Approximately 2 min	Limited instruction and controlled initial exposure.
Group Assembly and Countdown	Shared readiness	Approximately 3 min	Group positioning and countdown prompts.
Synchronized Emotes	Rising arousal	Approximately 3 min	Timed prompts and synchronized gesture cues.
Group Dance or Movement	Peak performative engagement	Approximately 4 min	Fixed-length movement sequence.
Sunset Viewing	Emotional consolidation	Approximately 3 min	Shared orientation toward a symbolic focal point.
Fire-Circle Gathering and Closure	Emotional tapering	Approximately 3 min	Spatial convergence and closing prompt.

Procedural Contingency and Session Integrity Protocols

Predefined contingency rules governed unexpected technical or behavioral disruptions to maintain session integrity. These rules helped ensure that minor technical problems did not unnecessarily interrupt the ritual sequence while also identifying conditions under which data would need to be treated cautiously. No sessions met the criteria for full termination. Minor deviations, such as delayed avatar movement, brief disorientation, or temporary movement away from the group, were handled through general facilitator prompts rather than individualized correction. This approach preserved the collective atmosphere of the ritual while allowing behavioral variation to be captured through the coding scheme described in [Appendix B](#).

Table A5
Contingency Handling Protocols

Event	Threshold	Procedural Response	Coding or Data Implication
Brief participant disconnection	Less than 60 s	Re-entry was permitted without restarting the ritual.	Affected phases were reviewed during coding.
Extended participant disconnection	More than 60 s	The session continued without interruption.	Data for affected behavioral segments could be marked incomplete.
Individual emote failure	Single participant only	No corrective intervention was made during the ritual.	The behavior was coded according to observed avatar action.
Minor system latency	Less than 1 s	Logged but did not interrupt the session.	Brief delays attributable to lag were not automatically penalized.
Major platform disruption	Session-wide disruption	Session termination or restart could be considered.	No sessions met this termination criterion.
Participant movement away from group	Temporary deviation	General group-level prompt was used if needed.	Proximity and engagement were coded according to observed behavior.
Inactive avatar	More than 5 s during a coded phase	No immediate correction unless necessary for technical support.	Inactivity was reflected in the behavioral coding score.

Appendix B. Behavioral Coding Codebook and Examples

This appendix presents the codebook used to analyze observable avatar behavior during the metaverse-based ritual event. The coding scheme was developed to capture visible indicators of ritual participation that could be observed from screen recordings, including avatar synchrony, spatial proximity, ritual engagement, orientation to ritual focal points, and ritual completion.

Behavioral coding was conducted at the level of the ritual phase unless otherwise specified. Each participant's avatar behavior was reviewed in relation to the phase-by-phase timeline described in [Appendix A](#). Two trained coders independently reviewed the recordings using the operational definitions and decision rules below. The coding process focused on observable behavior only and did not infer participants' internal emotional states. Self-reported emotional engagement, social presence, collective identity, and reconnection intentions were measured separately through the survey instrument in [Appendix C](#).

Table B1
Behavioral Coding Codebook

Behavioral Variable	Operational Definition	Unit of Analysis	Coding Values	Decision Rules/Notes
Avatar Synchrony	Degree to which participant avatar movements were temporally aligned with group ritual actions, such as gestures, emotes, or coordinated movements.	Ritual phase	0 = Not synchronous; 1 = Partially synchronous; 2 = Fully synchronous	Synchrony was coded when movement onset occurred within approximately ± 2 s of the group action. Brief delays attributable to minor lag were not penalized.
Spatial Proximity	Spatial distance between the participant avatar and the ritual focal point or group center.	Ritual phase	0 = Outside 3 m; 1 = Within 3 m	Distance was estimated using in-platform spatial markers. Avatars passing briefly through the zone for less than 2 s were not coded as within proximity.
Ritual Engagement	Observable behavioral involvement in ritual actions, such as remaining present, orienting toward the focal object, or performing required actions.	Ritual phase	0 = Low engagement; 1 = Moderate engagement; 2 = High engagement	AFK or inactive avatars for more than 5 s during a coded phase were coded as low engagement regardless of position.
Orientation to Ritual	Whether the avatar was visually oriented toward the ritual focal point, facilitator, or shared symbolic object.	Ritual phase	0 = No; 1 = Yes	Orientation was coded as "Yes" if the avatar faced the focal point for at least 50% of the phase duration.
Ritual Completion	Whether the participant remained present until the end of the ritual sequence.	Participant	0 = Did not complete; 1 = Completed	Temporary disconnections of less than 30 s followed by re-entry were still coded as completed.

Table B2
Behavioral Coding Examples

Behavioral Variable	Example of Code 0	Example of Code 1	Example of Code 2
Avatar Synchrony	The avatar did not perform the requested emote or performed an unrelated action.	The avatar performed the requested emote but started late or stopped early.	The avatar performed the requested emote and remained aligned with the group action.
Spatial Proximity	The avatar remained outside the designated group area or focal zone.	Not applicable because spatial proximity was coded dichotomously.	Not applicable because spatial proximity was coded dichotomously.
Ritual Engagement	The avatar was inactive, away from the focal area, or did not participate in the expected action.	The avatar remained present but showed limited or inconsistent participation.	The avatar remained present, followed prompts, and participated in the expected ritual action.
Orientation to Ritual	The avatar faced away from the sunset, fire-circle, facilitator, or group focal point for most of the phase.	Not applicable because orientation was coded dichotomously.	Not applicable because orientation was coded dichotomously.
Ritual Completion	The participant left before the ritual ended and did not return.	Not applicable because ritual completion was coded dichotomously.	Not applicable because ritual completion was coded dichotomously.

Coder Training and Reliability Procedure

Before formal coding, coders reviewed the full ritual timeline in [Appendix A](#) and discussed the operational definitions. A short calibration exercise was conducted using a sample segment of the screen recordings to ensure that coders interpreted the behavioral categories consistently. Disagreements during calibration were resolved through discussion and refinement of the decision rules. During formal coding, coders independently assigned scores to each participant's observable avatar behavior by ritual phase. Interrater reliability was calculated after independent coding. Reliability was high for the two primary behavioral indicators reported in the main text: avatar synchrony and spatial proximity. Disagreements were resolved through review of the recording and reference to the operational definitions and decision rules.

Interpretive Boundaries of Behavioral Coding

The behavioral coding scheme was designed to capture visible avatar behavior only. It did not directly measure participants' emotional states, motivations, or subjective sense of belonging. For this reason, behavioral indicators were interpreted alongside self-report measures rather than as direct substitutes for emotional engagement or collective identity. This distinction is important because the study examined whether observable coordination was associated with subjective collective identity. The coding scheme therefore provided a structured way to compare visible behavior with participants' reported affective and identificatory experiences.

Appendix C. Survey Instrument and Full Item Pool

This appendix presents the full post-event survey instrument administered to participants after the metaverse-based ritual event. The instrument was designed to capture participants' subjective experiences of emotional engagement, ritual participation, social presence, collective identity, and reconnection intentions. These constructs correspond to the study's conceptualization of VCC as an emergent configuration of affective, symbolic, and identificatory experience within a digitally mediated ritual setting. All items were rated using a five-point Likert-type response scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

	1	2	3	4	5
Emotional Engagement					
I felt emotionally moved during the event.	[]	[]	[]	[]	[]
The event left a lasting impression on me.	[]	[]	[]	[]	[]
I felt joy while participating in the ritual.	[]	[]	[]	[]	[]
I experienced a strong emotional reaction during the symbolic moment.	[]	[]	[]	[]	[]
I was emotionally invested in the collective experience.	[]	[]	[]	[]	[]
Ritual Participation					
I actively participated in the group ritual.	[]	[]	[]	[]	[]
The symbolic elements (e.g., sunset, fire-circle) were meaningful to me.	[]	[]	[]	[]	[]
I contributed to the group performance using emotes or gestures.	[]	[]	[]	[]	[]
I paid attention to the symbolic flow of the event.	[]	[]	[]	[]	[]
Social Presence					
I felt the presence of others around me.	[]	[]	[]	[]	[]
It felt as if I was sharing the experience with real people.	[]	[]	[]	[]	[]
I was aware of others' reactions and movements.	[]	[]	[]	[]	[]
I felt connected to the group even though it was virtual.	[]	[]	[]	[]	[]
The interaction felt socially real.	[]	[]	[]	[]	[]
Collective Identity					
I felt part of a meaningful group.	[]	[]	[]	[]	[]
I shared a common purpose with others in the event.	[]	[]	[]	[]	[]
I felt proud to be part of this group.	[]	[]	[]	[]	[]
I felt closer to the group because of the event.	[]	[]	[]	[]	[]
I identified with the group during the experience.	[]	[]	[]	[]	[]
I felt united with the others in the space.	[]	[]	[]	[]	[]
Reconnection Intentions					
I would like to participate in another similar event.	[]	[]	[]	[]	[]
I hope to reconnect with this group again in the future.	[]	[]	[]	[]	[]
I would recommend this experience to someone else.	[]	[]	[]	[]	[]

Data availability

Data will be made available on request.

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