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Emotion-Driven Intervention Design in Public Art Installations: Enhancing Visitor Engagement and Well-Being through Emotional Data Clustering

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Abstract:
Public art projects have enormous potential to enhance emotional well-being and inspire self-reflection; little research has been done on leveraging emotional data—absent demographic information—to design customized visitor treatments. Emphasizing elements like optimism, leisure, and utility, this article explores emotion-driven intervention design by analysing the emotional involvement of 6,559 visitors to the Happy Here interactive installation. Four emotional groups—K-means clustering helped guests to be separated: Cluster 1 (n = 1,187) showed the most engagement (e.g., optimism: 4.61, relaxation: 4.51); Cluster 2 (n = 774) exhibited the lowest (optimism: 1.54, relaxation: 1.33). Emotional clarity and problem-solving (r = 0.58), as well as optimism, relaxation, and usefulness (r > 0.5), were shown to be significantly correlated, thus suggesting that changing one emotion could increase general well-being. Temporal studies found the most emotional involvement during nighttime and weekend visits, suggesting that settings influence visitor experiences. These findings underline the significance of personalizing treatments to emotional profiles and maximizing exhibition schedules to improve involvement at high-impact periods. Using emotional data alone, this project generates adaptive and inclusive public art installations that foster deeper emotional relationships and enhanced visitor well-being, therefore setting the basis for future research and practical applications in the design of emotionally intelligent public spaces.

Keywords: Emotional engagement; Art installations; Emotion intervention; Well-being; K-means clustering.

INTRODUCTION

Applied to public art projects, current technologies have significantly influenced visitor involvement and created immersive, interactive events free from the restrictions of traditional displays. Virtual reality (VR), augmented reality (AR), and multimedia displays have altered public art and museum settings by providing dynamic, thrilling events that improve emotional attachments and promote interaction [1]. Big data technologies close the gap between physical, digital, and social components [2], enabling tailored frameworks ideal for visitor experiences depending on their choices and increasing these revenues. For instance, prominent data-based adaptive display topologies allow many sites to change to fit visitors' interests and time constraints, providing a more customized and significant cultural experience [3].

Real-time emotion identification technologies created by AI-driven installations—such as those created by the Wuhan Museum of Science and Technology—have enhanced human-to-human relationships and artwork, advancing society goals like well-being and sustainability [4]. Oversized data methods also find usage in cultural settings and companies evaluating visitor comments and emotional feedback, improving interactive designs and user experiences [5]. Sentiment analysis so also proved helpful. For example, installations like "Mood of the Planet" create immersive emotional experiences using visual and audio feedback linked with global sentiment data, therefore reflecting collective emotional states [7].

Applying psychological theories helps even the development of emotionally driven intervention strategies. Emotion Regulation Theory emphasizes how people control their emotional responses using cognitive reappraisal, a technique made possible by public art installations, thus promoting emotional reflection [8]. Interesting and demanding events help Self-Determination Theory (SDT) emphasize the part autonomy, competency, and relatedness play in inspiring intrinsic drive; it also suggests that interactive designs supporting emotional agency might increase visitor involvement without using demographic data [9]. Flow Theory states that in which guests attain maximal emotional immersion and well-being [10], interesting and demanding experiences contribute.

Public art initiatives are increasingly important, given the worldwide focus on mental health and well-being, since they allow people to reflect emotionally and achieve mental wellness. Emphasizing the need for treatments, including well-being, in public spaces, the World Health Organization (WHO) defines mental health as a healthy state that transcribes the absence of disease [11]. Interactive art projects provide inclusive and easily accessible means for emotional processing and social connection as rates of anxiety and depression rise. Studies on art-based initiatives in galleries have found that they can enable significant social contact, therapeutic involvement, and emotional reflection [12].

Despite these advances, public art projects sometimes lack demographic information—a standard tool for tailoring treatments. As such, there is little research on developing emotionally driven treatments grounded only on emotional data. Recent studies indicate how emotional clustering and real-time feedback systems could offer exceptional experiences; however, their use in public art is under consideration [7]. This study satisfies this demand by considering how emotional data could guide the development of public art initiatives, therefore offering a new substitute for standard demographic-based methods.

This paper tries to assess the viability of emotionally driven therapy approaches based on emotional data. This project intends to generate targeted, flexible solutions that enhance engagement and well-being using visitor responses and emotional change evaluation. Emotion Regulation Theory, Flow Theory, and Self-Determination Theory together provide a foundation for developing unique, emotionally driven strategies to increase visitor experiences and improve mental wellness in public art contexts.

LITERATURE REVIEW

These days, interactive digital exhibits are important for increasing viewers' emotional involvement. More immersive experiences created by virtual reality (VR), augmented reality (AR), and multimedia art, among other technologies, kick-off more powerful emotional reactions than traditional displays. Research shows that these technologies can create multi-sensory experiences that increase emotional involvement, give guests more relevance, and recall value from displays. For example, virtual reality displays' dynamic visual and aural stimuli could surround visitors in different worlds and influence their emotional states [13]. These surroundings enable visitors to participate more emotionally in the performance, inspiring closer respect for the exhibition theme.

Flow theory holds that persons enter a flow state when they are entirely engaged in an activity with a demanding but attainable goal suited for their capacity level [9]. This disorder influences not just emotional involvement but also general quality of life. The immersive features of digital art exhibits could lead spectators to enter "flow," therefore enhancing their involvement in the event and their emotional connection with the given content. The flow experience fits more nicely since people sense better emotional connection and fulfilment [14].

Most of the improvement of visitors' experiences in digital art displays is determined by emotional computing, computer recognition, interpretation, and replication of human emotions. Real-time emotional recognition technologies let exhibits become adaptive surroundings that react to the audience's emotional states, improving the interaction between guests and the artistic creations. Designed to satisfy visitor happiness, VimoNet is a facial expression and body gesture-based emotional detection system that produces tailored content [15]. This emotional interaction generates following interactions and catches every response, creating a feedback loop between the artwork and the observer. These systems satisfy self-determination theory (SDT [10]), highlighting the need for autonomy, competency, and relatedness in producing internal motivation and well-being. Visitor personalization made possible by affective computing helps to improve display autonomy depending on their emotional response. Combining SDT ideas will enable visitors to actively participate in self-directed emotional analysis and personal growth rather than merely be consumers. User interaction will thus become evident.

Digital art installations' emotionally charged intervention design significantly enhances public space mental health and well-being. Modern research permits individual emotional input to enable tailored, interactive designs and treatments to increase emotional control and mental wellness. Substantial visual and aural clues of interactive art allow visitors to control significant events, increasing self-awareness and emotional processing [17]. Especially in the post-pandemic era, marked by increasing psychological stress, these works can have a therapeutic effect using audience emotional resonance [18], thereby reducing tension and anxiety. The theory of emotional resonance explains how humans change their emotional states through cognitive reappraisal or suppression methods. Public art projects, with their dynamic, real-time emotional input, serve to regulate emotions. Using emotionally resonant therapies built on real-time emotional states, these installations enhance general mental health, enabling visitors to control their emotions better. Research showing the connection between reappraisal techniques, better emotional results, and better mental health supports this conclusion. Furthermore, flow theory suggests that interactive designs fit the capacity and demands of visitors and could help them experience the best emotional states while interacting with the art. By assisting guests in digesting their emotional reactions and enabling a sense of flow as they interact with different areas of the installation, a well-crafted intervention can help guests control their emotions and boost their participation in the exhibition.

Although the possibilities of emotional personalizing independent of demographic data are unexplored, current research on personalized interventions in art installations mainly relies on demographic data (such as age, gender, and background) to modify experiences. This work closes this disparity by designing therapies grounded only on guests' emotional reactions. Moreover,

even if emotional-based therapies are extensively studied in clinical environments, their utilization in non-clinical public venues—such as interactive art installations—is unusual. One possibility is investigating how public art may employ emotional recognition to support well-being in informal, community-oriented settings. Current research on emotional-driven interventions also usually focuses on instantaneous feedback without considering how visitors' emotional states may change over time in long-term installations. This leaves a void in adaptive intervention strategies that can react to changes in emotional patterns over extended interactions. In the end, even though affective computing has been included in art installations, its methodical integration into public health policies—especially for enhancing mental well-being in community situations outside of conventional healthcare—is still growing. Therefore, this work offers emotions-driven designs in public art installations to encourage mental well-being and emotional reflection in post-pandemic environments. Through art, the study enhances public health by filling in these gaps; emotional data can guide focused initiatives in public areas to raise well-being. This advances both flexible digital installations and emotions-driven interactions.

RESEARCH METHODOLOGY

Data Source

This research uses the HappyHere dataset collected during a 12-week interactive exhibition at the National Galleries of Scotland from December 2018 to February 2019. The exhibition's aim, HappyHere, was to explore the convergence of mental health, emotional well-being and art technology. We instructed participants to assess their emotional states using the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS). This instrument emphasizes the assessment of positive mental health in non-clinical settings. This research uses the HappyHere dataset collected during a 12-week interactive exhibition at the National Galleries of Scotland from December 2018 to February 2019. The exhibition's aim, HappyHere, was to explore the convergence of mental health, emotional well-being and art technology. The Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS), which focuses on assessing positive mental health in non-clinical settings, instructed participants to rate their emotional state.

The dataset includes 6,500 individual interactions with emotional dimensions, including optimistic, relaxed, helpful, close people, and one's mind. We rated each dimension on a Likert scale from 1 (low) to 5 (high). In addition to these emotional responses, the dataset includes time-based environmental factors such as time of day (day vs. night) and interactions between weekdays and weekends. Anonymizing the dataset ensures privacy and focuses exclusively on emotional patterns.

Emotional Clustering and Intervention Strategy Design

Based on emotional data from the Happy Here exhibition, this study proposes numerous treatments by grouping visitors based on their emotional states. K-use clustering and the Elbow method determine the appropriate number of clusters and segment visitors using primary emotional traits: optimism, relaxation, usefulness, social connection, and mental clarity. This clustering method enables us to investigate many ways of emotional interaction among guests and offer specific solutions fit for the features of every cluster.

Moreover, this clustering approach is supported by flow theory as it also argues that interactions aimed at the emotional and cognitive level of a visitor could generate maximum connection. While less involved clusters could require interactive components to produce optimism and relaxation and enable people to acquire a flow state, clusters identified as more engaged could benefit from contemplative, silent installations that improve their emotional connection. Therapeutic approaches are supposed to be followed in keeping with ideas of emotional regulation. Low emotional state groups will help us offer emotionally driven therapy, guiding guests in emotional control. This can consist of planning interesting events to increase brain activity or clarity. Ultimately, using exhibition sites or event modifications, self-determination theory (SDT) helps to build a recommender system that fits the emotional profile of every cluster. The first emphasis of this strategy is the autonomy and competency of guests so they may interact with their surroundings, fulfilling their emotional demands. Emphasizing human needs and self-reflection instead of statistical data, these customized approaches enhance the guest experience.

RESULTS

Emotional Differences Across Visitor Groups

The K-means cluster analysis split the 6,559 visitors into four different clusters (Table 1: Cluster 0 (2,007), Cluster 1 (1,868), Cluster 2 (1,031), and Cluster 3 (1,653) based on their emotional responses. Every cluster showed different levels of emotional involvement, especially in areas related to optimism, leisure, and perceived usefulness. The Happy Here installation mirrors varying degrees of emotional involvement and interaction depending on these differences. OfCluster 1 had the best degrees of

emotional involvement and the most positive emotional reactions among all the groups. Responding somewhat well emotionally to the gadget, cluster members scored on average 4.46 for optimism and 4.18 for relaxation. Strong emotional and social ties among group members demonstrated that the instrument considerably enhanced their welfare in social and economic spheres. Cluster 0's average optimism was 3.62, while its relaxation score was 2.05. Although this group was emotionally engaged, their responses indicated a more moderate impact, particularly about relaxation. Cluster 2 usually had the lowest emotional involvement, with average evaluations of 1.74 for optimism and 1.49 for relaxation. This group hardly engaged with the artwork, implying either a lack of interest or a connectionlessness. Cluster 3 showed only modest emotional involvement with values above Cluster 2 but below Clusters 0 and 1. The mean optimism score was 3.33; the relaxation score was 3.85. This group is emotionally attached even if their replies were more restrained than in the more favourable groups.

Table 1. Mean emotional scores across clusters

Cluster	Optimistic	Relaxed	Useful	Close People	Own Mind	Problems	Clearly
0	3.84	3.27	3.50	3.57	4.02	3.53	3.57
1	4.61	4.51	4.55	4.72	4.72	4.59	4.62
2	1.54	1.33	1.32	1.40	1.40	1.25	1.27
3	3.14	2.48	2.80	3.00	3.00	2.60	2.60

Clusters 1 and 0 show significantly more substantial emotional involvement than clusters 2 and 3, depending on emotional ideals and their feelings of optimism, leisure, and usefulness. This suggests that, notably, Cluster 2, who either scarcely engaged emotionally, the installation had more positive effects on some groups of visitors than others.

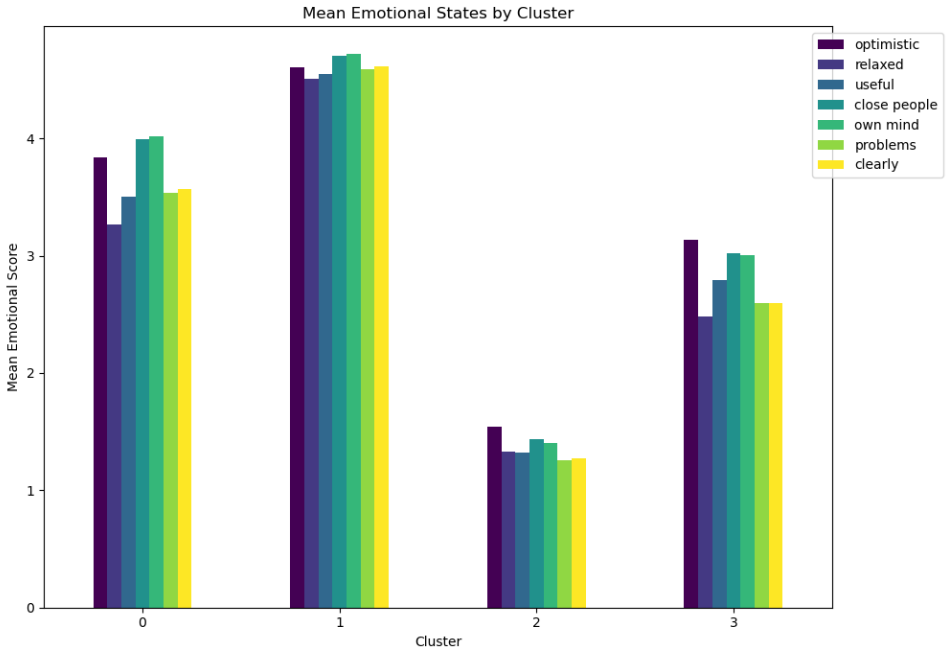

Figure 1. Mean emotional states by cluster

Figure 1 graphically shows the variations in emotional states, including optimism and relaxation, between clusters. The picture emphasizes the need for tailored interventions to increase engagement for groups like cluster 2 since it clearly displays the huge variation between highly engaged clusters (1 and 0) and less engaged clusters (2 and 3).

Impact of the Interactive Installation on Emotional Changes

Figure 2 demonstrates, during the 12-week Happy Here installation, the emotional trends across clusters in main dimensions: optimism, leisure, and usefulness. This investigation reveals different emotional reactions; some clusters exhibit more substantial involvement at specific presentation times. Cluster 1 usually scored highest in emotional involvement, particularly in terms of fun and relaxation. The peak of these emotional states between early January and late February corresponds to particular exhibition parts, presumably related to environmental changes or visitor activity levels, thereby generating more powerful emotions in this group. The notable degree of involvement indicates that the installation and these phases enhanced visitors' emotional connection in Cluster 1. Hence, they were usually favourably affected.

During the concert, Cluster 0 had relatively constant emotional levels. However, value and hope dropped sharply around the end of January and the beginning of February as the performance continued. Although this group stayed very involved, the diminishing ratings imply that the novelty of the presentation or its capacity to sustain emotional connection over time may have lost appeal for some guests. Cluster 3 was emotionally intense for many individuals during the twelve weeks. Early in February, the increase in leisure and hope exposed some aspects of the installation or outside events, possibly with a delayed emotional impact on this group. Lagging behind Clusters 0 and 1, Cluster 3's emotional reaction was more reactive than proactive, even with this adjustment. Cluster 2 displayed constant low emotional involvement in all emotional spheres and slight variation over time. The fact that this group considered the exhibit primarily dull suggests inadequate materials, a lack of suitable emotional appeal, or poor design. This implies that specific initiatives have to help to raise cluster participation.

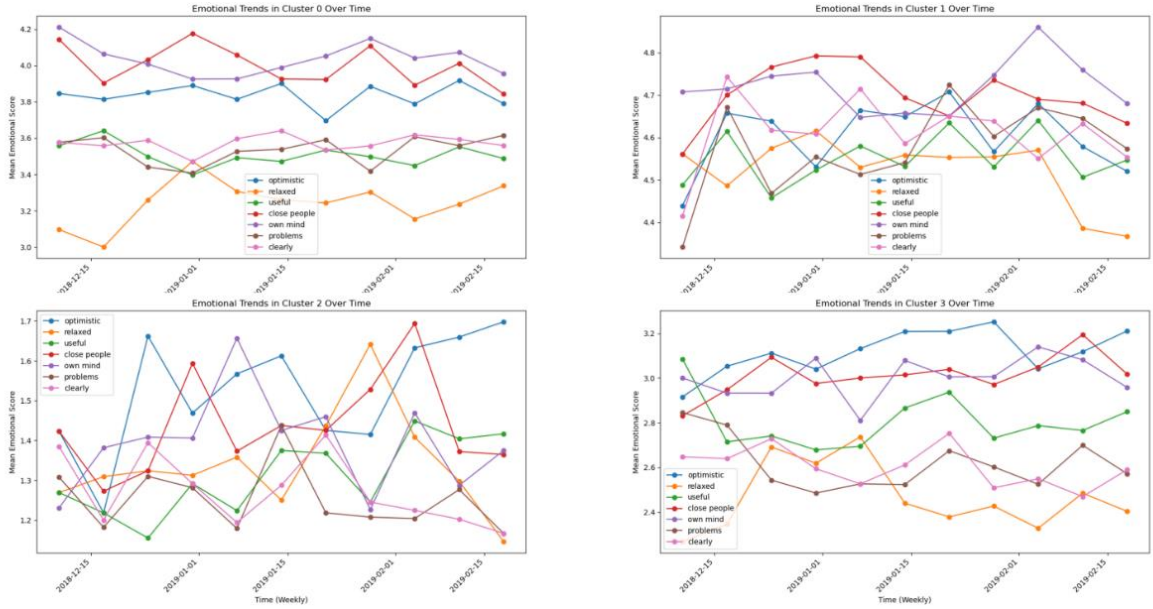

Figure 2. Emotional trends in different cluster over time

The graph depicts how the emotional states of Optimism, Leisure, and Usefulness change within each cluster. Cluster 1 peaks in early January and late February, while Cluster 0 shows more stable but rapidly declining counts. Cluster 2 is generally lower; Cluster 3 shows varying degrees of engagement. Based on the pattern, Cluster 1 reacts more strongly to different areas of the event and shows more emotional engagement during peak times. In contrast, Cluster 2 shows minimal reactions, suggesting that more architectural adjustments or interventions are needed to accommodate this group. Changing engagement levels for Cluster 3 suggests that this group may need more dynamic or interactive elements to keep members emotionally engaged over time.

Emotional Clustering and Intervention Design

First, we investigate the relationships among the primary emotional states experienced during the Happy Here installation to build efficient intervention techniques based on emotional reactions. Together with a clustering technique, these relationships offer helpful information for creating tailored well-being initiatives that fulfil the multiple emotional needs of various visitor groups.

Emotional correlations and clustering

The correlation matrix emphasises important correlations among the main emotional components: optimism, relaxation, usefulness, and problem-solving (Figure 3.). Emotional clarity and problem resolution ($r = 0.58$) and cognitive clarity and self-confidence ($r = 0.57$) indicate quite a high positive link. Since it implies that guests who showed more emotional clarity were more suited to solve challenges, this reflects the exhibit's success in generating notable emotional involvement and cognitive thinking. The interactions among optimism, leisure, and utility ($r > 0.5$) imply that variations in a cheerful emotional state will most likely produce variations in other pleasant emotions. These findings support the theory that concentrated therapies aiming at positive emotions, such as optimism, could enhance visitors' general emotional condition.

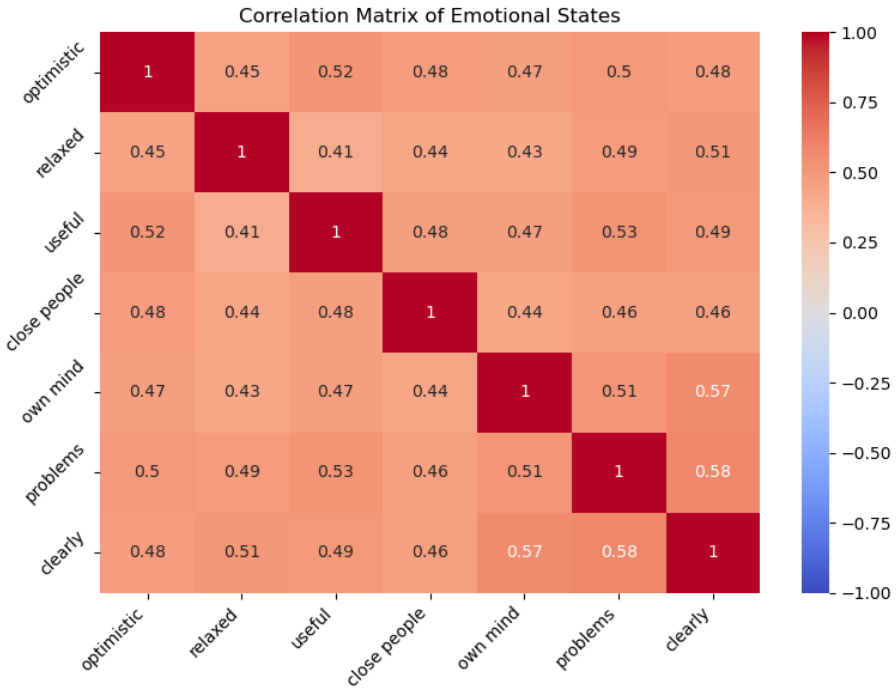

Figure 3. Correlation matrix of emotional states

Emotional clusters and intervention potential

We classed guests based on emotional responses using K-mean clustering applied via correlation analysis. Cluster analysis revealed four distinct emotional clusters, each with distinct patterns of emotional involvement (Figure 4). Strong emotional involvement defines Cluster 1, which displays more significant results on all criteria—especially in optimism (mean score 4.61) and relaxation (mean score 4.51). The positive emotional response of the group suggests a Happy Here tool that would have included them and created a fascinating and engaging experience. We classified guests based on emotional reactions using K-mean clustering applied through correlation analysis. Cluster analysis revealed four distinct emotional groups, each with distinct patterns of emotional involvement (Figure 4.). High emotional involvement Group 1 demonstrated remarkably on all criteria—especially optimism (mean score of 4.61) and relaxation (mean score of 4.51). The good emotional responses of this group point to the Happy Here gadget, which is linked to them providing an intriguing and immersive experience.

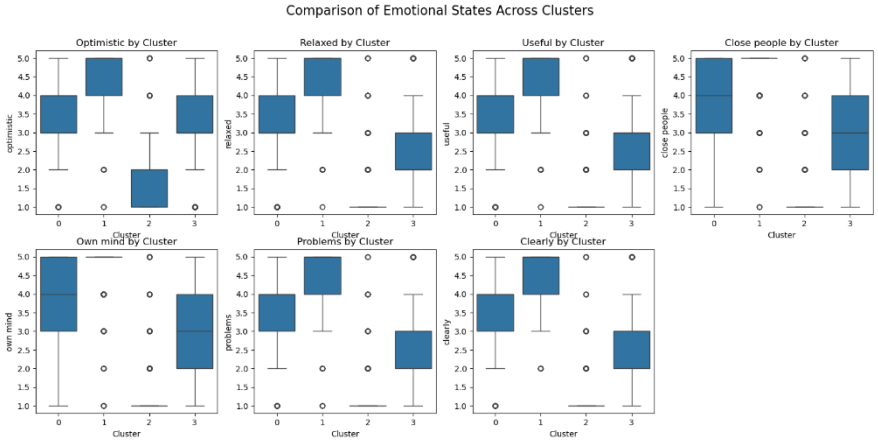

Figure 4. Comparison of emotional states across clusters

Among groups with scores much below the others, Cluster 3 showed the lowest emotional engagement. The low emotional involvement of the group implies that the individual elements of the exhibition or installation had less impact on them. Customized wellness initiatives targeted to stimulate emotional involvement and enhance the visit experience using better surroundings usually target this demographic. Both groups demonstrated low emotional involvement even if Cluster 0 indicated

considerably higher emotional clarity and usefulness than Cluster 2. While therapies that enhance their emotional experiences would help the intermediate groups, their replies point to a broader, albeit weaker, link with the performance.

Environmental Factors and Emotional Changes

Figure 5 shows the comparability of the emotional states among the groupings over time. Particularly in categories like optimism, leisure, and social contact, Cluster 1 usually shows visitors with the most strong and positive emotional experience. Conversely, Cluster 2 frequently shows guests with the lowest emotional connection and scores lowest on emotional aspects.

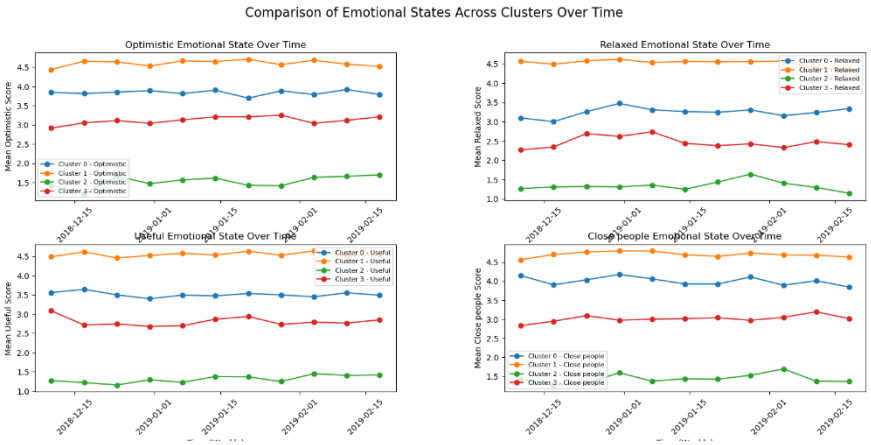

Figure 5. Comparision of Emotional states across clusters over time

Day vs. night emotional differences

Day-to-night analysis of emotional states reveals distinct emotional involvement. Unlike day visits, guests reported they felt more friendly and energetic late at night. Table 2 shows that, with a mean = 3.76, optimism ratings were somewhat higher at night than during the day (mean = 3.49). Higher ratings of social connection in nighttime (mean = 3.55) and daytime (mean = 3.49) demonstrated comparable results. Visitors also noted they felt more loved at night (mean = 3.41) than during the day (mean = 3.2). Emotional lucidity dropped somewhat at night (mean = 3.31 instead of 3.19 during the day). The results suggest that evening events boost emotional involvement and generate a better general experience.

Table 2. Comparison of emotional states across day and night

Period	Optimistic	Relaxed	Useful	Close People	Own Mind	Problems	Clearly
Day	3.49	3.03	3.22	3.49	3.53	3.17	3.19
Night	3.76	3.07	3.41	3.55	3.45	3.28	3.31

Weekday vs. weekend emotional differences

Table 3 also shows emotionally how weekends were not like weekdays. With 3.57, the mean of weekend visitors showed more hope than those arriving during the week. Visitors also observed that they typically felt more concentrated on weekend visits, implying that weekends provide a more emotionally intense involvement. These results draw attention to how context and timing affect emotional involvement.

Table 3. Comparison of emotional states across weekday and weekend

Emotional State	Weekday Average	Weekend Average
Optimistic	3.41	3.57
Relaxed	3.04	3.02
Useful	3.14	3.29
Close People	3.46	3.55
Own Mind	3.52	3.49
Problems	3.24	3.27
Clearly	3.14	3.24
Total (7-35)	22.73	23.53

DISCUSSION

This study shows how particular emotional response data-leading methodologies can guide the development of emotionally driven interventions inside public art exhibits, enhancing visitor involvement and welfare through clustering analysis. We divide 6,559 visitors into several emotional groups using K-means clustering, exposing fascinating variations between groups and the impact of outside events on emotional states. Supported by Flow Theory, Emotion Regulation Theory, and Self-Determination Theory (SDT), our results indicate how carefully targeted interventions may increase emotional involvement and reflection.

Research on emotional involvement in cultural surroundings shows that public art projects aiming at mental health improvement could primarily benefit from this (Smith et al., 2018; Johnson, 2020). Our study backs up this with Cluster 1 results showing constant high engagement with mean scores of 4.61 in optimism, 4.51 in relaxation, and 4.55 in usefulness. Flow Theory offers a framework for analyzing these facts since visitors in Cluster 1 most certainly experienced a flow state—where their emotional states matched the exhibit's needs, optimizing engagement [9]. On the other hand, Cluster 2, with less participation (optimism = 1.54, relaxation = 1.33), stresses the importance of emotional control techniques to raise interaction. According to Emotion Regulation Theory, therapies meant to assist Cluster 2 visitors in controlling and enhancing their emotional experience in the exhibit—that is, guided interactive components or relaxation areas—may be helpful [8].

Temporal study reveals changes in emotional involvement over time, differing maxima in optimism and relaxation in early January and late February. Maintaining a somewhat energetic pace at these intervals, Cluster 1 responded to the dynamic, immersive aspects of the program. Cluster 3 exhibits delayed involvement—particularly in mid-exhibition—but Flow Theory contends that this connection creates more substantial emotional experiences. From this vantage point, visitors show more natural drive and curiosity over time as they become more independent and competent. Interventions designed especially for Cluster 3 could progressively provide increasingly tricky tasks, which would help sustain emotional engagement as visitors continue through the exhibition.

Research of the interactions among emotional components provides the necessary knowledge for treatments aiming at well-being. For example, the strong positive link between emotional clarity and problem-solving suggests that enhancing clarity could help visitors more effectively negotiate challenges. Moreover, interactions between optimism, leisure, and utility ($r > 0.5$) suggest that intentional improvement of one emotional component can raise overall well-being. Cluster analysis helps to verify these findings by classifying visitors into numerous emotional categories with varied needs. Regarding active participation, Cluster 1, SDT advises initiatives promoting autonomy and competency to increase involvement. Including autonomous exploring possibilities or always providing challenging materials, for example, could help preserve this cluster's natural motivation and involvement. Interventions focused on emotional regulation and connection would benefit Cluster 3, the group with the lowest emotional involvement. Emotion Regulation Theory presents hope coupled with deliberate meditation points or interactive cues inspiring relaxation, social interaction, and leisure. This approach lets one insist on social interaction settings to create a closer emotional link between the artwork and guided stimuli.

How this study tackles environmental factors—such as time and day of the week—opens excellent possibilities to enhance public art installation techniques. Our results suggest that late-night visitors participate emotionally in a more active way. Things seem bright, with average optimism ratings of 3.76 vs 3.49 during the day and social connection scores of 3.55 instead of 3.49 in the daytime. These results suggest that evening activities offer environments fit for introspection and communication. Treatments for evening events should thus comprise several elements promoting social connection and introspection, like gloomy lighting, new contemplation settings, and group-guided activities, facilitating essential connections between the artwork and other guests. Weekend guests responded more attentively to emotional engagement. On weekdays, their optimism was 3.57 instead of 3.41; their total emotional score was 23.53 instead of 22.73. More subtle treatments could direct group projects, interactive seminars, or sensory-enhanced exhibitions, boosting weekend visitors' emotional participation and social interaction opportunities.

The study results provide public art curators and cultural organizations with sensible instruction and emotionally charged advice. Treatments aimed to increase emotional connection—through interactive elements encouraging reflection or social participation—may benefit Cluster 2, which is less involved. Including components that inspire active participation—such as interactive or hands-on activities—may help Cluster 3, which revealed low general involvement, draw more members. By matching the degree of the exhibit's challenge with the visitors' emotional condition, Flow Theory helps to build engagement and flow over several emotional spheres. Emotional projects enable cultural institutions to use their outputs to enhance visitor interaction, raising society's standard of living. Projects like the Marikana Massacre Memorial and those driven by artist-activists [20,21] highlight the effectiveness of focused interventions as demonstrated by public art installations using socially active tactics involving many individuals. Less active groupings like Cluster 2 could encourage the encounter using group viewing facilities

or cooperative events to encourage social engagement and intellectual stimulation. The dynamic and colourful elements of Cluster 3 could offer impressive, immersive experiences clusters. Leading visitors depending on SDT principles employing implicit exhibition components suitable for their emotional profiles promotes their autonomy. Studies on this strategy show that visitors could customize their experience and increase pleasure and closer connection by focusing on exhibit aspects most relevant to their current emotional states and requirements. Including emotional data in public art projects, at last, provides cultural institutions with the tools to produce outstanding events relevant to many guests. Public art initiatives directly and quite successfully inspire introspection, emotional participation, and mental well-being using suitable instruments for the emotional profile of every guest cluster.

CONCLUSION

This paper investigates the possibilities of emotional data to transform public art experiences, increasing visitor involvement and well-being by thoroughly examining emotional-driven intervention design inside the Happy Here interactive display. After aggregating the emotional reactions of 6,559 visitors, we found four distinct emotional groups and investigated how weekday/weekend affect emotional states altered with time of day. Key results show Cluster 1 as the most active; peaks in optimism and leisure most express themselves during evening and weekend visits. On the other hand, Cluster 2 showed the lowest levels of involvement, suggesting that customized treatments might help this group become emotionally involved. This research underlines the need for emotional-driven interventions in producing original, intense experiences in public art installations; it also implies that more reflective elements could help highly involved clusters while interactive elements could improve the emotional connection for less-engaged groups.

Though additional elements should be considered, this study produces intriguing findings. First, the K-means clustering method generates spherical groups and may only partially capture complicated emotional patterns, even if it is advantageous for visitor segmentation. Future research using more complex emotional groupings should uncover density-based or hierarchical ones, among other clustering techniques. Second, this study largely depended on emotional data and minimal demographic information that would have given the entire picture of visitor interaction. Combining psychological and demographic information can allow one to understand the elements affecting visitor experiences. At last, the research findings depend on one exhibition shown in the National Galleries of Scotland, limiting the generalizability of the conclusions. Future studies should repeat this investigation in multiple public art and cultural environments to investigate whether comparable emotional clusters and involvement patterns are detected in different surroundings, improving the applicability.

Future studies should overcome these limitations and evaluate using the long-term impacts of emotionally driven interventions on visitor well-being through longitudinal studies. Such studies can examine if emotional contact with public art shows consistent outstanding psychological well-being even outside of the main event. Furthermore, research on the feasibility and effectiveness of real-time emotional feedback systems included in public art installations is very much needed. One can produce more lively and responsive visitor experiences using flexible and expressive reactions. Furthermore, cross-cultural studies would be very significant since one's emotional reaction to art depends on social, cultural, and environmental aspects. Future research aiming at a perfect understanding of visitor interactions with public art might profit by thus establishing intervention strategies for many audiences using multimodal data collecting and mixing emotional, physiological, and behavioural data.

This piece highlights the need for emotionally driven interventions in creating original, engaging public art experiences that encourage emotional development and well-being. By focusing on emotional data, cultural organizations can produce shows that satisfy various emotional needs and consequently offer good visitor experiences free from depending on demographic data. These outcomes provide a solid basis for creating targeted treatments based on emotional grouping, promoting more inclusive, entertaining, and flexible public art venues. Future research should seek long-term benefits to support well-being, raise emotional involvement among many civilizations, and more widespread applications of emotional-driven design in public environments.

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