

Social Flow

Social connectedness and flow in participatory art

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Abstract

Zeitgeist - a participatory artwork developed by the researcher/artists Dr Shama Rahman and Dr Olive Gingrich, uses deep-learning algorithms to indicate creative 'Flow' mental states visualised on a holographic Pepper's ghost display. Based on real-time analysis of physiological brainwave data through deep-learning algorithms, participants visually experience the probability of being in Flow - a mental state of creative peak performance (Nakamura & Csikszentmihalyi, 2002). Forming part of the AHRC-funded p_ARTicipate research project, this research looks at the effect of participatory arts on social connectedness and mental well-being. A small-scale pilot user study (n=12), points to a significant effect of the intervention on social connectedness, mood and flow - with facilitation being a potential confounding factor. This paper presents the findings of this initial pilot study, as well as a discussion around co-factors of social flow.

Keywords: Inclusion - Visualisation - Artificial Intelligence

Introduction

Zeitgeist measures whether audiences are in a Flow mental state - a state of increased creative stimulation, reduced stress and increased engagement - using deep-learning algorithms for Flow detection from brainwaves as measured via EEG – an electroencephalogram which monitors brain activity. Zeitgeist analyses this data and represents Flow states as visual cues on a holographic display - a process called 'nudging'. Lighter colours and more complex forms represent a heightened state of Flow. Darker colours and simpler forms represent lower states of Flow. These visual cues provide information to the participants on their creative stimulation in real time. In her PhD, Rahman found a biomarker for the creative Flow state within experimental paradigms of creative performance (Rahman et al., 2021). Trained on this biomarker data, deep-learning algorithms classify new brainwave data from wearables as real-time correlates of Flow (Adnan et al., 2020). Research suggests a direct link between participatory art and social connectedness (Gingrich et al. 2019). Zeitgeist builds upon this research, using creative engagement to enable social Flow, resulting in social connection, reduced stress, and a greater sense of well-being.

Zeitgeist has previously been shown at Ars Electronica, EVA London Conference, and Poole Museum. The initial pilot study presented here took place at Somerset House, engaging pairs of users (n=12) in a series of facilitated creative activities while visualising Flow states in real time. Pre- and

post-intervention surveys, as well as interviews and observation point to insights into key factors of flow. While different people seem to respond differently to different types of participatory engagement, Flow states seem to be easier reached by participants with a degree of knowledge of meditative practices which have a cross-over in open monitoring. Exercises include humming, wordplay and improvisation. Joy and a degree of cognitive challenge including speed seem to be contributing factors to Flow. Participants reported deeper social connectedness post-intervention, as compared to normal (non-intervention) social ice-breaker activities.

Research Context

p_ART_icipate examines a set of research questions on the impact of participatory art interventions on social connectedness among the UK public including vulnerable populations disproportionately affected by social distance. Over the last decade, artistic practitioners (M. Abramovic, P. Sermon), policy-making bodies (UK Parliament, local councils), health organisations (NHS Foundation Trust, PHE), cultural organizations (Southbank, Tate) and academics (MIT's Co-Creation Studio, Centre for Performance Science) investigated means to improve societal well-being through creative engagement. Whereas the effect of participatory art on health and wellbeing is widely researched (AHRC Connected Communities, Evidence Review Mental Health Foundation), important questions remain about best practices for art facilitation online. Post-Covid-19, we face an urgent need to understand the potential of technology-facilitated art to alleviate the effects of social isolation in remote working and living conditions. Recent research points to an increase in loneliness, isolation and sensory deprivation during COVID-19 (Fancourt 2020, Venkatesh 2020). The Office for National Statistics estimates that 14.3% or 7.4 million people across the UK felt their well-being being affected due to loneliness ("lockdown-lonely") during lockdown (ONS 2020). Health issues associated with social isolation and loneliness frequently include depression, anxiety, chronic stress, and insomnia (Wilson et al. 2007, Stickley & Koyanagi 2016, Sepulveda-Loyola et al. 2020). While the effects of participatory engagement on social connectedness within quality relationships are well supported, there remains a significant knowledge gap on the role participatory tools play in an arts and health context, particularly in combatting sensory deprivation resulting from isolated living and remote working conditions.

Remote working conditions pose a major challenge for UK employers and employees post-Covid-19 with an immediate need to improve tools for collaborative work processes to combat social isolation and sensory deprivation. Equally, psychological side-effects of working from home are largely unexplored, as effect on productivity: Remote working conditions can lead to a decrease in perceived social connectedness, as well as loneliness. Between 2019 and 2022 working from home across the UK more than doubled from 4.7 million to 9.9 million people (Office for National Statistics 2023). There is clear evidence on the impact of participatory arts providing opportunities for meaningful social contact, as a means against loneliness (Mental Health Foundation's Evidence Review on Participatory Art 2011). Greater social connectedness has been linked to a lower risk of cancer recurrence, higher survival rates following a heart attack, lower blood pressure, better immune responses, and better psychological well-being (Cohen 2004, Stansfeld 2006, Uchino et al. 1996). Recent research suggests that the effects of social isolation and sensory deprivation can be mitigated through participatory media arts experiences (Tymoszuk, Fancourt, et al. 2020, All-Party Parliamentary Report 2017). p_ART_icipate estimates the effect of participatory art on social connectedness focusing on the UK public, including four discrete, vulnerable populations. The artwork *Zeitgeist* forms part of this research, focusing on creative practitioners and healthcare workers.

As working-from-home (WFH) conditions are rapidly increasing, new tools are needed to mitigate side effects of remote working such as sensory deprivation and feelings of disconnection and loneliness, with social isolation being linked to a higher risk of heart attacks, mental disorders and mortality

(Holt-Lunstad et al. 2015, Hakulinen et al. 2019). The potential for participatory arts to contribute to mental health and well-being has been the subject of parliamentary debates, all-party parliamentary reports, research by the Arts Council of England and recent academic research (Fancourt 2019, Billington et al. 2013).

According to the All-Party Parliamentary Report on the Arts, Health and Wellbeing (2017) 82% of people living in deprived communities engaging in participatory art practices enjoyed greater wellbeing. The Parliamentary report calls for increased interdisciplinary, cross-council research by Research Councils UK and individual research councils in the areas of participatory arts, health and wellbeing. The AHRC report 'Connected Communities' on participatory arts and wellbeing singles out the importance of facilitation practices for beneficial outcomes. While a large body of evidence points to strong causal evidence on the effect of participatory arts on mental health and perceived social connectedness (Dadswell et al. 2020, Mansfield & Daykin 2020, Perkins & Williamon 2014, Fancourt & Perkins 2018), little research exists on the potential for participatory arts to contribute to social connectedness online, a knowledge gap that needs to be filled in the context of social distancing. Research supports the importance of sensory experiences in facilitating social connectedness and preventing feelings of loneliness (Heatley Tejada et al. 2020); however, in societies already affected by loneliness prior to the pandemic, the role of social and sensory deprivation remains understudied. This case study investigates the effect of digital participatory arts on social connectedness and Flow.

Flow, Creative Engagement, Participatory Art

Flow increases intrinsic motivation (Veenhoven 1984), meaningful engagement and absorption (Csikszentmihalyi, 1990), and importantly, improves mood and happiness (Diener, 2000; Diener & Diener, 1996). 'Flow' mental training is proposed to enhance cognitive performance, creativity and productivity. Previously, Flow cognitive training has been shown to improve cognitive abilities in those with traumatic brain injury (Yoshida et al., 2018). Cognitive training leads to neuroplastic changes and stimulates cognitive functions (Keshavan et al., 2014). However the relationship between Flow and social connectedness remains understudied, and Zeitgeist's pilot study addresses this.

The first use of the term 'participatory arts' can be to an art review by Richard Ross for the Los Angeles Institute of Contemporary Art (Ross 1980). The effect of participatory arts on mental health has been the subject of a range of studies pointing to a direct effect of participatory arts engagements on self-esteem and confidence (Marmot 2004, Wilkinson 1996), on dignity (Horton 2003) and psycho-social notions of identity following illness (Clift et al. 2008, Daykin et al. 2008). A meta-analysis review of the impact of arts on dementia and cognitive processes by Young et al. highlights the potential for creative activities to raise attention, aid the stimulation of memories, and enhance communication (Young, Camic & Tischler 2015). Together with individual research efforts, research centres, networks, conferences and the many support structures through funding bodies such as the Wellcome Trust, NESTA, and Baring Foundation, this field of interdisciplinary is facing a different set of challenges in a post-COVID context: The focus now lies on research into design, facilitation and accessibility challenges within participatory arts - both physically as well as online, as well as the need for new evidence on the effect of participatory arts on social connectedness. The Zeitgeist case study focuses on the effect of a participatory arts intervention on Flow- states, mood and social connectedness.

Zeitgeist Interface

Incoming EEG data is received via Bluetooth and then analysed via a Python script through NeuroCreate's proprietary deep-learning algorithm in real time to calculate the probability of Flow

states. This probability is a floating points value between 0 and 1 which is then parsed on using an Open Sound Control (OSC) protocol to a Touchdesigner (<http://www.derivate.ca>) patch. This visual coding software allows for real-time representation of these incoming values, which are mapped onto two Moebius strips - one for each participant. The colour of the Moebius strips responds to the user's probability of being in Flow, with warmer colours (golden and warm teal/blue tones) indicating a likely Flow state and cooler colours (purple/violet tones) the potential absence of Flow. The scale and visual complexity of the resulting shape are influenced by a shared flow factor, computed by adding both participants' Flow states. Participants can observe their own Flow state, as well as one of their interlocutors in real-time.

Participatory Arts Facilitation

Participants were invited to two facilitated exercises which included a shorter onboarding activity (2-5 minutes average) consisting of humming, and a longer cognitive exercise (10-15 mins). The humming activity serves as a way of allowing participants to 'arrive and ground' both individually and with each other. They are prompted to hum with the facilitator and each other such that they can choose to hum the same note or harmonise. Participants can treat the facilitator's note as a base, such that there are no leaders but rather more collectively they can choose to move the melodies and harmonies. This requires active listening to 'blend' notes and serves as a way of synchronising breathing, which may have a knock-on beneficial impact on the ability to achieve Flow states together and to connect to each other. The second exercise begins with an associative wordplay. Participants are prompted to respond to their partner's suggested word with their own association. As they are asked to respond fast, they may begin with associations that may be considered 'obvious', however, the facilitator preempted the intervention by proposing that participants may wish to challenge each other as they went on, with an aim to 'surprise' and make each other laugh. From single-word associations, the facilitator then encouraged the movement to full phrases of association and dialogue. The overall facilitation duration typically lasted between 15 - 20 minutes and was framed by a pre- and post-survey. Participants were also invited to write free-flowing thoughts and comments following the post-surveys and intervention.

Evaluation

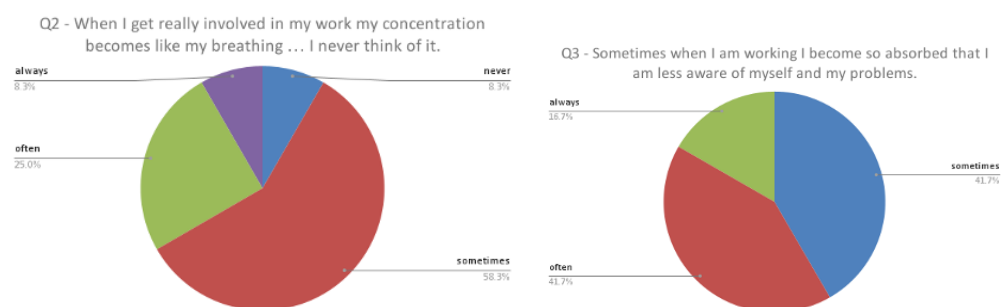
Throughout the interventions, data was collected pertaining to 5 main areas. Incorporating existing models of flow analysis, participants were provided with pre- and post-questionnaires: the former exploring flow propensity (likelihood of entering a flow state), social connectedness (specifically, their perceived closeness to their partner-participant prior to the intervention), and mood; the latter exploring their flow reflection/self-analysis during the intervention, and social connectedness and mood post the intervention. Building upon Csikszentmihalyi's Flow Questionnaire (FQ) (1975), flow propensity was determined by asking participants key questions regarding the historic experience of common flow states. Using a multiple choice Likert scale (never, sometimes, often, always), participants were asked about 3 key components of flow, in the form of the following questions:

- *When I get really involved in my work my concentration becomes like my breathing ... I never think of it.*
- *Sometimes when I am working I become so absorbed that I am less aware of myself and my problems.*
- *When I am working I am so involved in it that I don't see myself as separate from what I am doing.*

By assessing participants' capacity for, and relationship to, concentration, temporality and self-awareness, it was posited that we could determine their overall likelihood of entering a flow state. This information – alongside their mood (measured on a 7-point Likert scale, across 4 categories: alert/drowsy, happy/sad, active/passive, involved/detached), and social connectedness (measured on a 7-point Likert scale, in response to the question 'how close do you feel to the other participant?') – allowed us to contextualise the EEG data in order to determine whether engagement with the intervention had had a tangible effect on their mental-state. Finally, the post-questionnaire incorporated further questions reflecting on the participants' experience during the intervention. These questions were consistent with Csikszentmihalyi's (Jackson & Csikszentmihalyi 1999) componential view of flow, wherein the flow state is characterised by nine main components: focused concentration on the present activity (concentration), sense of control over one's actions (control), merging of action and awareness (merging), autotelic experience (autotelic), loss of self-consciousness (self-consciousness), loss of time awareness or time acceleration (time), clear proximal goals (goals), unambiguous feedback (feedback), and dynamic balance between challenge and skill (balance). The post questionnaire presented 8 questions that engaged with each of these topics in the form of a simple yes/no response, and these were: 'I had complete concentration on the task', 'I had clarity of goals and reward in mind', 'I had a feeling of control over the task', 'I had a balance between challenge and skills', 'I had a transformation of time', 'I had an intrinsically rewarding experience which was the end in itself', 'I had an effortlessness and ease of experience', 'I had a merging of action and awareness losing self-conscious rumination'

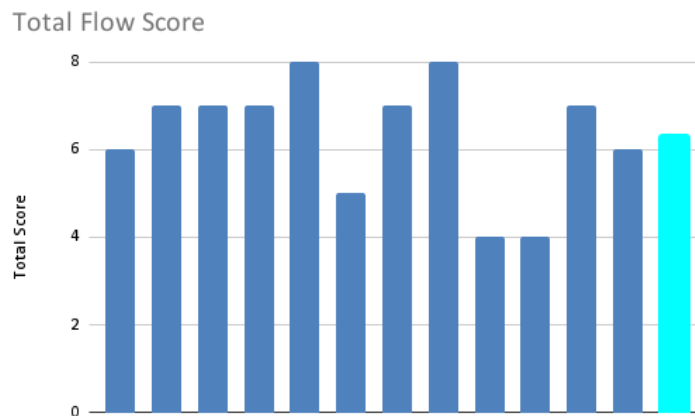
Results

Although working with a limited number of participants, the results nonetheless suggest some meaningful correlation between participation in the installation, social connectedness, and flow. In the first instance, the participants demonstrated a high propensity for flow, with similar results across all 3 categories (concentration, temporality, self-awareness). In each instance, a total of 83-84% of participants reported sometimes or often experiencing flow characteristics.

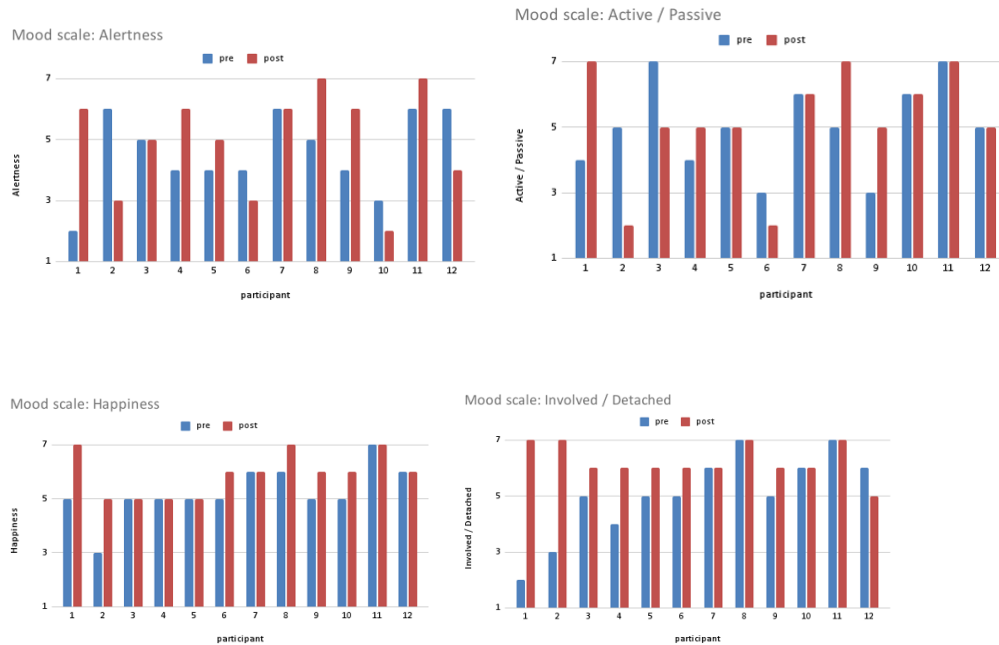




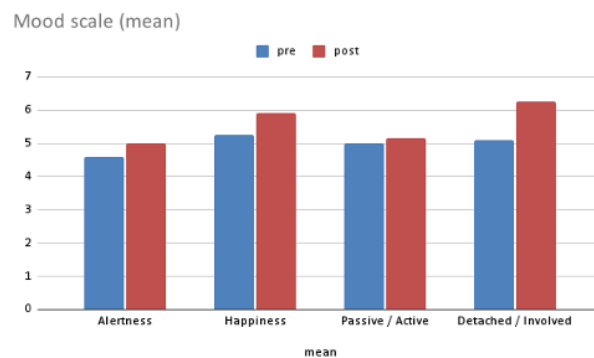
The post-intervention self-analysis suggested an equally high instance of flow amongst the participants. Using their yes/no answers to the 8 questions, participants were assigned an overall flow score, between 0 (all no's) and 8 (all yes's). 9 out of 12 participants scored 6 or above, with an average rating of 6.33. Of the 8 criteria, 'I had a rewarding experience' rated the highest (91.7%), followed by 'I had a transformation of time' (83.3%), 'I had a balance between challenge and skill' (83.3%), and 'I had an effortless and ease of experience' (83.3%). In contrast, 'I had a feeling of control' scored the lowest (58.3%). It is perhaps worth noting that the language of such questions, though drawn from Csikszentmihalyi's research, is not entirely neutral. The nuance between challenge/skill and effortless, for instance, might require further unpicking to be truly meaningful, whereas a question regarding a 'rewarding' experience risks eliciting platitudes, although they were answered anonymously, there may still be a risk if it is perceived the researchers are in presence.



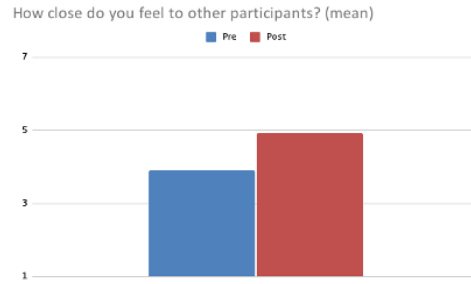
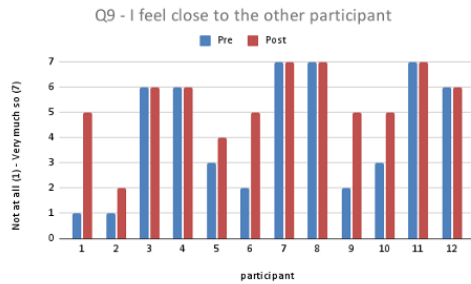
Comparisons between the pre- and post-intervention mood scales suggested significant changes in the participants' well-being and engagement. Whilst only half of the participants reported feeling more alert afterwards, the increase in alertness was pronounced, and only a quarter of participants reported being less alert. All participants reported feeling as happy or happier after the intervention, though by less dramatic margins. A third of participants reported feeling more active, though a quarter reported a significant drop in activeness. The most pronounced results were found in the involved/detached category: 7 out of 12 participants reported significant increases in involvement, with only 1 participant reporting any increase of detachment.



Taken as a whole, participants reported an average positive increase across all categories, with the most pronounced increases in involvement and happiness. Performing a two-tailed Paired T-test showed significant p-values of .04129022 for involvement and 0.01282582 for happiness.

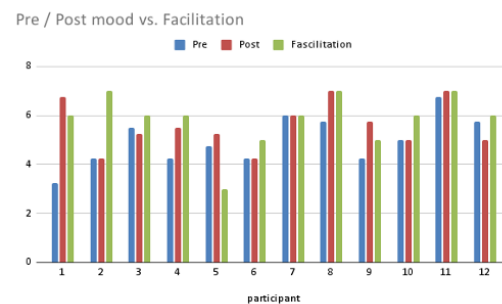


Lastly, participants self-reported an equally significant increase in social connectedness. Although somewhat lacking in context (no differentiation was made, for instance, between participants with an already established social bond and those meeting for the first time during the intervention), these results suggest the intervention did have a positive effect on how close participants felt to one another. Half of the participants reported feeling closer to their partners after the intervention, with half feeling the same level of closeness as before. Perhaps pointing back to our earlier query regarding how well participants knew each other before the intervention, all of the participants who reported no increase in closeness, were already close to begin with. In contrast, there were significant increases in closeness for those who felt distanced at the start – perhaps suggesting the intervention was more effective in forging social bonds amongst strangers than increasing connectivity amongst associates.



Overall, there was a small but significant increase in social connectedness, rising from an average of 3.9 (on the 7-point Likert scale) to 4.9. Performing a two-tailed Paired T-test showed significant p values 0.03227 for social connectedness shown by graphical means and .00004386 for social connectedness when asked the question 'How close do you feel to other participants?'

What is less clear, however, is the role facilitation played in the pursuit of social connection. Whilst participants broadly responded positively to the facilitation (both as observed by the researchers and rated in the post-questionnaire), there was no obvious correlation to their overall flow score. Whilst it felt clear to the researchers that the facilitation was helping participants to engage more deeply with the intervention, it's precise effects were no doubt mitigated by a range of exterior factors (how well the participants knew each already, the environment in which the intervention took place, etc.).



Comparing the pre- and post-mood analysis to the facilitation rating, we can see that although a higher post-mood average correlated to a higher facilitation score, high facilitation scores were given regardless of the size of the increase in mood. Again, whilst observationally the facilitation had a positive effect on both mood and social connection – participants seemed more at ease as the facilitation progressed, resulting in more playful and creative responses to their structured conversations – a more nuanced investigation is required to determine exactly how facilitation can be best used for this purpose.

Conclusion

The concept of 'Social Flow' as a shared, synergetic variation of Flow mental states postulates a link between social connectedness, and individual Flow experience. While the presented study is currently only a pilot with a limited sample size, results point to a significant relationship between participatory art intervention and mood, and importantly a link with perceived social connectedness. These findings support existing evidence on the effect of participatory arts engagements and social connectedness and wellbeing. However, the link between Flow and Social Connectedness has not been studied in detail and prompts intriguing questions about the nature of flow as as complex and multifaceted phenomenon. Future research involving the research partners CNWL NHS Foundation Trust,

NeuroCreate and the University of Greenwich will investigate potential dependencies between social connectedness and flow - as either interrelated or distinct co-factors of wellbeing. Participatory arts are based on the ideas of communalities, shared experiences, and social collaborative experiences. As participatory interface the Zeitgeist project offers new insights into the complex relationship between design, facilitated experience, and their effect on wellbeing.

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