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Synaesthetic emergence: a scoping review of factors facilitating synaesthetic states in non-synaesthetes through arts engagement

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ABSTRACT

Synaesthesia is defined as a multi-sensory phenomenon in which one sense can be triggered by another without external stimuli, for example seeing colours when hearing music. This paper maps findings from the literature to describe what elements of arts engagement facilitate synaesthetic experiences among non-synaesthetes. The rationale for this study is on the basis that evidence shows multi-sensory experiences underpin creative innovations and serve as a foundation for embodied wellbeing practices. Through a scoping review guided by the PRISMA-ScR framework, this study identifies eight interdependent themes within which combinations of factors have the potential to produce synaesthetic states: *Inviting Co-creation, Participatory Embodiment, Cultural and Social Engagement, Embodying Cognition, Producing Affective Intensity, Stimulating Associative Memory, Unifying Sensory Engagement, and Sensory Digital Enhancement*. The review spans a diverse array of arts engagement practices, music, dance, visual arts, performance, and culinary events, to investigate how these modalities can evoke synaesthetic experiences in non-synaesthetes. The methodology employs deductive thematic synthesis informed by a new materialist perspective. The findings support the hypothesis that under particular conditions co-creative arts engagement can blur traditional sensorial boundaries, demonstrating that participatory arts can elicit embodied synaesthetic states in non-synaesthetes. The study also provides insights into how synaesthetic experiences in arts engagement influences perception, cognition, and social interaction, offering innovative pathways to enhance wellbeing and promote social cohesion. These findings have implications for the use of arts-based interventions in fostering multi-sensory engagement and expanding understanding of synaesthetic states with non-synaesthetes and the potential effects on wellbeing.

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Introduction

Defining synaesthesia is a difficult task within the plethora of academic discourses, ranging from psychology to creative arts publications often attempting to define a minoritarian occurrence from a majoritarian perspective. Synaesthesia easily becomes rarefied, anomalous or at worst abnormal. However, it is widely accepted, even from a neurological perspective, that synaesthesia involves the stimulation of one sensory modality triggering a response in a second sensory modality (Hubbard & Ramachandran, 2005). This can encompass a wide range of sensory experiences, revealing that senses can be deeply enmeshed with perception. For example, sound, smell, flavour are inseparable from the languages that mobilise cognitive and perceptual functions such as words, numbers, graphemes, or names of days or months. For a synaesthete, these sensed and procedural elements involuntary, automatically, consistently and unilaterally activate a non-externally stimulated sensation (Bragança et al., 2015). In simple terms, this can be called a type of 'mixing of the senses' (Ward et al., 2008). The mechanisms of synaesthesia can be likened to the processes underpinning metaphor, whereby each element is synthesised to produce an excess beyond a simple comparison, for example, 'sweet silence' or 'loud colours' (Shen, 1997, Shen & Aisenman, 2008). This study

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provides an exploration and thematisation of a range of texts to clarify the factors required to produce synaesthesia through participatory arts for non-synaesthetes, providing some clarity regarding the event that takes place rather than becoming overly deterministic or increasing conceptual elusiveness (Simner & Ludwig, 2012).

The implications of synaesthetic -like experiences happening with non-synaesthetes are manifold, and in particular we noted that synaesthesia has been shown to enhance memory recall (Bankieris & Aslin, 2016; Gosavi & Hubbard, 2019; Mulvenna et al., 2013; Paivio, 1969; Smilek et al., 2002), foster creativity and problem-solving (Chun & Hupé, 2016; Julmi & Scherm, 2015; Merter, 2017; Mulvenna, 2007; Mulvenna et al., 2013; Sitton & Pierce, 2004; Ward et al., 2008), increase curiosity and exploration (Domino, 1989; Lingham, 2013; Murgia & Murgia, 2015; Rothen & Meier, 2010), and heighten sensitivity to stimuli, both internal and external (Banissy et al., 2009; Bowling et al., 2019; Hossain et al., 2018; Lebeau & Richer, 2022).

We do not dismiss the possibility that the consistent and predictable manifestation of synaesthesia in certain individuals represents an intrinsic characteristic distinct from the experiences of the majority. This notion is confirmed through studies investigating neurological differences present from birth, as compared to synaesthesia acquired later in life due to sensory modifications or the influence of psychoactive substances. Evidence points to genetic factors contributing to structural and functional brain variations, a theory further supported by the familial prevalence of synaesthesia (Asher et al., 2008; Bargary & Mitchell, 2008).

There is also evidence supporting the theory of neural pruning failures or disinhibition processes (Grossenbacher & Lovelace, 2001), as well as other neurological factors such as local cross-activation, re-entrant processing, and disinhibited feedback (Dixon et al., 2004; Hubbard & Ramachandran, 2005; Maurer et al., 2020; Ramachandran & Hubbard, 2001a, 2001b; Smilek & Dixon, 2008) resulting in unusual levels of neural plasticity (Shriki et al., 2016), normally evident in early stages of childhood, although this has been contested as a misconstrual of data available (Deroy & Spence, 2013a, 2013b; Maurer et al., 2013).

The authors of this paper recognise personal and situated knowledges in relation to investigating synaesthesia. The first author, Havsteen-Franklin, is an art psychotherapist by background and a Professor of Practice (Arts Therapies), and whilst having a strong interest in synaesthesia does not identify as a synaesthete. His focus is on understanding the impact of arts on wellbeing and health in social contexts. His interests therefore are more specifically about developing ethical relations through arts and the related mechanisms of change. The second author, Perboni, is a synaesthete (sound-colour, sound-touch, grapheme-colour, and time-space) and throughout the research process, the identified research sources have been selected and interpreted based on first-hand experience of being a synaesthete. For example, the scientific study of synaesthesia, from an experiential perspective were considered to be helpful in understanding biological and neurological dimensions of synaesthesia, however from Perboni's perspective, scientific knowledge such as mapping neurological change was also experienced as having biased limitations based on normative models of creating binary boundaries between senses, concepts and experience. From Perboni's experience the arts feel fluid, explorative and as a synaesthete offer an insight into multi-modal effects and affects of synaesthesia. Therefore, in Perboni's experience the arts expand perceptions, rather than reduce phenomena, and use the senses to produce a complex tapestry of possibilities (see also Massumi, 2002).

Methods

In order to cut through the perceptive – cognitive – neurological divides, we employed a new materialist methodology. This philosophy flattens the hierarchies of human and nonhuman data. Following Fox and Alldred's (2015a, 2017, 2022) method of analysis, their model focuses on relations, affects, and capacities—each being in dynamic relation with one another. From a new materialist viewpoint, relations are the connections between entities that are active agents in the emergence of experience (Hickey-Moody, 2015). Therefore, from this perspective, relations involve intra-active interdependencies that contribute to the becoming of synaesthetic states. This view challenges the idea of relationships between active subjects and static objects and instead proposes that the object-subjective relations, are themselves forms of dynamic agency. In this sense, new materialism suggests that the arts produce dynamic assemblages (Feely, 2020; Fox & Alldred, 2015b) where our interactions with materials, sounds, visuals, and the

environment are orchestrated to contribute to the actualisation of new experiences, exceeding what might be possible of the intra-active elements in isolation (Lupton, 2019).

The second key concept – ‘affects’, is different from but can include emotions in new materialist thought (van der Tuin & Dolphijn, 2010). Affects are the intensities that flow through and between entities, which can enhance or diminish a body’s capacity to act or be acted upon, including concepts, artistic expression, technologies or emotions. Van Der Tuin and Dolphijn state

‘Not primarily interested in representation, signification and disciplinarity, new materialism is fascinated by affect, force and movement as it travels in all directions. It searches not for the objectivity of things in themselves but for an objectivity of actualisation and realisation’ (van der Tuin & Dolphijn, 2010, p. 169)

Van Der Tuin and Dolphijn’s theory suggests that affects traverse the boundaries of bodies and the external world, between tangible and intangible. This perspective suggests that affects are what motivates us within action; they are the forces within our interactions and the reactions that emerge from them. In the context of synaesthesia, affects are the resonances that are sensed through the body, responding to and provoking new modes of perception and sensation. ‘Capacities’, the third concept in this context’ refers to the ways that affects can increase or decrease the potential for change in complex systems. DeLanda (2018) suggests that capacities are not fixed but are subject to the influence of affective interactions and relations. Likewise, Golańska (2020) writes that capacities are the possibilities for variation and becoming within the synaesthetic landscape, shaped through the intra-actions that individuals have with their environments where synaesthetic experiences may amplify, reduce, grow or diversify one’s scope for engagement with the world.

The methodological framework employed in this study is based on the five-stage scoping study approach outlined by Arksey and O’Malley (2005) to ensure a thorough and systematic analysis. The primary research question driving this review is: *‘How can arts engagement contribute to synaesthetic experiences in non-synaesthetes?’* Relevant literature was identified through systematic searches conducted in the following databases; CINAHL Plus, ERIC, MEDLINE, APA PsycArticles, and APA PsycInfo. To ensure inclusivity and to validate the search terms, supplementary searches were also carried out using *Google Scholar*. Keywords and phrases used in the search included adjustments of the following, adapted for the specific databases: ‘Synaesth*’ OR ‘Synesth*’) AND (‘art* expression’ OR ‘art*’) AND (‘Affect*’ OR ‘Impact*’ OR ‘Influence*’) AND (‘being with other*’ OR ‘Social*’ OR ‘Interpersonal’).

Inclusion and exclusion criteria were developed prior to the literature search. Studies were selected if they explored synaesthesia in relation to artistic processes, participatory arts forms, or digital interface with arts, published in English from January 2000 to 2024 in line with the development of dominant discourses within the field. Articles were excluded if they were not focusing on synaesthetic experience, social contexts or the arts. The selection followed the PRISMA extension for scoping reviews (PRISMA-ScR), ensuring clarity and transparency in reporting. The process involved a three-phase flow process, documenting the number of records identified, included and excluded, and the reasons for exclusions.

Data were charted from the included studies to capture key information, such as authors, year of publication, study design, population, artistic domain, synaesthetic experiences discussed, and key findings related to the research question (See Table 1).

Table 1 serves as a summary of key data drawn from the included papers, including authors, arts medium, participatory context, study designs, populations, number of excerpts that were coded as relevant to the research question, artistic domains, synaesthetic experiences addressed, and outcomes. It is structured to encapsulate the nature of the studies, showing how various forms of arts—function within specific participatory contexts, such as educational settings, performances, and social interactions. The reviewed studies describe synaesthetic experiences across various artistic mediums and participatory contexts. The authors predominantly focused on adult populations, with the addition of a few papers addressing children and general audiences. The studies cover a diverse range of art forms such as visual arts, cinema, dance, music, culinary events and literature. Various research methodologies were cited in the identified papers, including experimental, practice-based, phenomenological analysis, and literature reviews. Geographic representation was widespread, encompassing regions including the UK, USA, Germany, Japan, and Brazil. Some authors investigated the active participation of individuals in the arts, while others focused on dynamics of spectatorship or social contexts. Through different methodological

Table 1. Descriptive data from the selected papers.

	Author	Arts medium	Participatory Context	No. of excerpts	Research methods	Population	Location
1	Banfield, (2016)	Drawing, Dance	Arts participation, Spectatorship	13	Practice-based research	Adults	UK
2	Barker (2016)	Cinema	Active arts participatory spectatorship, cinema audience	18	Theory development	Adults	USA
3	Barker, (2016)	Cinema	Arts / spectator	21	Phenomenological analysis	Adults, general population and Children	USA
4	Dowdy (2007)	Music, disco	Active arts participatory spectatorship	1	Theory development	Adults	n/a
5	Filip (2019)	Text, literary	Spectatorship/ reader, cultural engagement	2	Literature review	Adults	Germany
6	Gander (2012)	Poetry	Active arts participatory spectatorship, reader	2	Poetry analysis	n/a	UK
7	Hoff (2018)	Transmedia	Sociocultural	2	Literature review	Adults	Germany
8	Hunt (2016)	Arts (General)	Arts / Spectator	3	Literary review	Adults	Canada
9	Julmi and Scherm (2015)	Mixed media	Arts / spectator	4	Phenomenological analysis	Adults, general population	Germany
10	Kirby (n.d)	Multi-disciplinary	Active arts participation	4	Theory development	Adults	Germany, Austria, France, USA
11	Klisanin (2005)	Multi-disciplinary	Active arts participation, spectatorship	4	Theory development	Adult, general population	USA
12	Kuby (2013)	Image making	Active arts participation	12	Experimental / mixed methods	Children	USA
13	Lock (2008)	Music	Arts Improvisation/ active arts participation/ spectatorship	3	Comparative analysis / qualitative	Adults	UK and France
14	Lopez et al. (2013)	Movement	Social	5	Quantitative study, experimental	Adults, general population	Switzerland, France.
15	Machon (2009)	Text, Playwriting, Play, Performance, Theatre, Acting	Arts performance	16	Practice-based	Adults, general population	UK
16	Miyahara (2014)	Social aesthetics, Visual arts	Everyday passive and active participation /social	4	Experimental	Adults	Japan
17	Piquero Alvarez (2020)	Dance	Performance, active arts participation	59	Choreographic analysis, hermeneutic analysis		Malta and UK
18	Probst (2009)	Mixed mediums	Arts spectator / performance	5	Theory development	Adults, general population	
19	Ribeiro and Szafir (2012)	Multi-disciplinary, installations	Active arts participation / spectatorship	3	Speculative research, artistic experiences	Adults	Brazil
20	Ryan and Wollan (2013)	Festivals, events	Active arts participation / spectatorship	4	Theory development	Adults	Norway
21	Scarlett (2015)	Digital media	Active arts participation / spectatorship	6	Theory development	Adults	n/a
22	Slattery (2006)	Language	Social	4	Experimental	Adults, general population	USA
23	Turner (2019)	Visual Arts,	Education	1	Autoethnographic and theorisation	Students and Adults, general population	UK
24	Vogts and Costandius (2017)	Food	Arts participation, multimedia	10	Action research	General population	South Africa
25	Zhang (2019)	Poetry	Reading	4	Theory development	Adults	n/a

lenses, these studies collectively highlight the complex ways in which synaesthetic experiences can emerge within the arts, offering an overview of themes and contexts that contribute to a nuanced understanding of this phenomenon.

This review process was iterative, with continuous updates as further literature was reviewed. Data were collated and analysed thematically. Braun and Clarke's (2006) method of thematic analysis was employed, with an initial phase of familiarisation with the data, followed by generating codes. These codes were then collated into potential themes, reviewed against new materialist concepts and refined into a thematic framework that aligned with the research question.

Thematic analysis

Following established research practices, two independent reviewers engaged in the coding of data extracted from the selected articles. This dual-coding process aimed to mitigate individual biases and enhance the analytical rigour of the study. Disagreements between reviewers were resolved through discussion, promoting consensus and ensuring a more robust interpretation of the data (Braun & Clarke, 2006).

Each identified theme was carefully evaluated and aligned with the research question and objectives of the review. This alignment was crucial to ensure that the resultant themes contributed meaningfully to the narrative of the review, addressing the overarching research inquiry comprehensively (Nowell et al., 2017). The theme was then cross-referenced against the existing literature to anchor the findings within the broader academic discourse, the methodological framework and validate their relevance and contribution to the field (Thomas & Harden, 2008).

Reflexivity was a cornerstone of the process, with researchers continually reflecting on their backgrounds, perspectives, and potential biases. This reflexivity is critical in qualitative research, as it acknowledges the researchers' influence on the interpretation of data and helps maintain transparency in the analytical process (Malterud, 2001). The iterative nature of the scoping review process facilitated the emergence of additional themes and sub-themes as the review progressed, reflecting the dynamic and complex nature of the subject area (Arksey & O'Malley, 2005).

Moreover, the iterative process allowed for ongoing adjustments to the review scope and depth, accommodating new insights and ensuring comprehensive coverage of the field. This approach aligns with Levac et al. (2010) recommendations for enhancing methodological rigour in scoping studies by incorporating a reflexive and iterative strategy in both the selection and analysis phases.

By systematically relating the emergent themes back to the central research inquiry and maintaining a reflexive stance throughout the process, the thematic analysis conducted in this scoping review adheres to rigorous methodological standards and contributes an extended mapping of synaesthetic states.

Results

This scoping review adopted the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach to ensure a thorough and transparent method. Our search strategy yielded a total of 299 records. Additionally, a search through Google Scholar for grey literature contributed 20 more records, culminating in an initial total of 319 articles (Figure 1).

The screening process began with a review of titles and abstracts against our inclusion criteria, leading to the exclusion of 233 records due to irrelevance to the topic at hand. This left us with 86 records eligible for full-text assessment. Upon further review, articles were excluded based on specific criteria: 26 articles were omitted for not including a relational context relevant to the study, 17 were discarded for not incorporating the arts, and 18 were removed for not being specific to synaesthesia.

After this screening process, 25 articles met all criteria and were included in the final review. These studies were then analysed to construct a comprehensive understanding of the factors that can induce synaesthetic experiences in non-synaesthetes, aligning with our aim of expanding conceptual clarity.

The thematic analysis of the codes showed insights into the conditional factors that may promote synaesthesia for non-synaesthetes. From 25 articles that met our inclusion criteria, we coded 222 excerpts

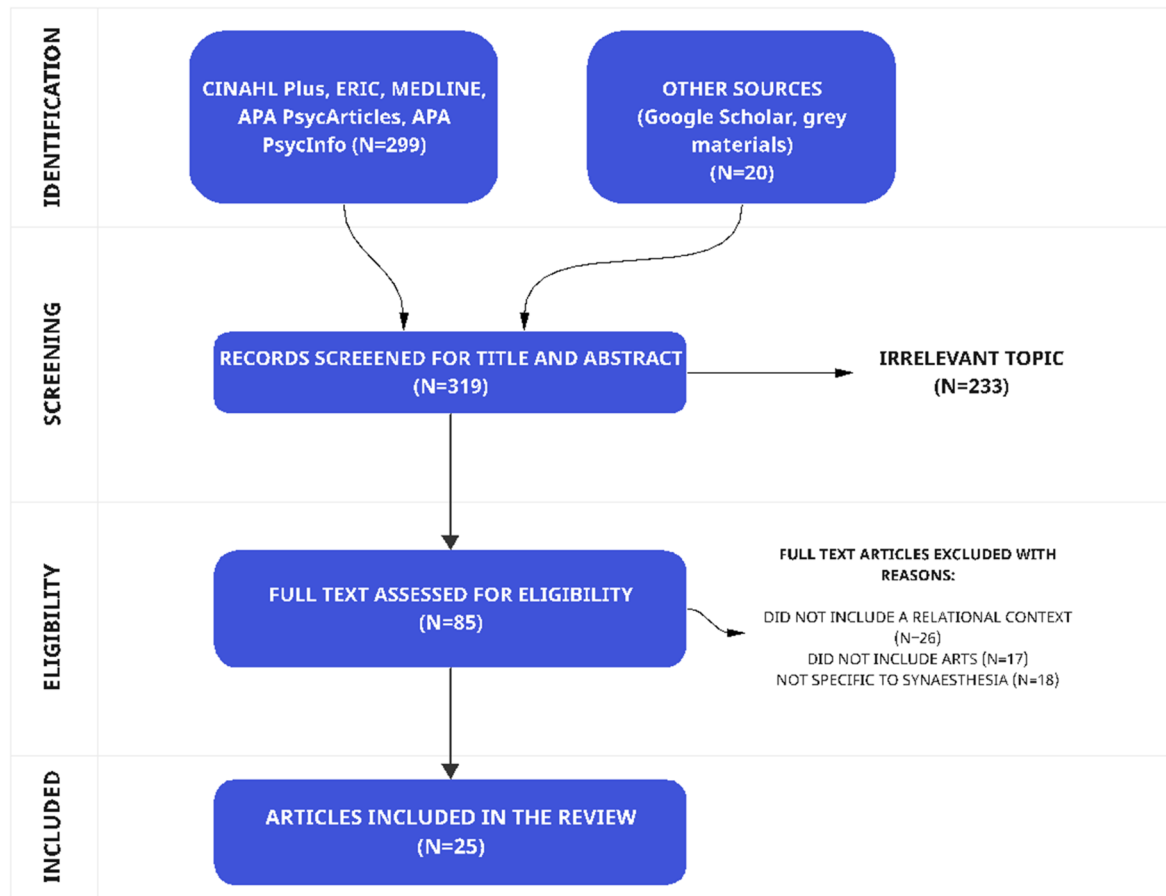


Figure 1. Results of the database search using a PRISMA process.

to produce eight themes that elucidated the factors contributing to the production of synaesthetic states within non-synaesthetes. A flowchart (Figure 2) was developed to visually represent the thematic elements identified in the data. This includes elements such as the arts experience, contributing factors, synaesthetic states, and associated benefits.

According to Zhang (2019) and Miles, Huberman, and Saldana's (2014), visual representation can be instrumental in providing a comprehensive overview of the thematic structure, effectively capturing the relationships and stages that lead from one domain to the next (See also McCrudden & Rapp, 2017, Bazeley & Jackson, 2013; Tufte, 2001).

Themes

The thematic analysis revealed cross-sensory events within a range of arts contexts. In the subsequent sections, we present these themes—each representing an element of an interconnected pathway through which synaesthetic states can be produced and understood in individuals not inherently predisposed to synaesthesia.

Inviting co-creation

The concept of co-creation was used to define moments where the inclusion of the audience, observer or witness co-creates the art form with aesthetic results that are beyond the awareness or intentions of the artist to bring about a synthesis of senses as integral to the artistry of the event. The reviewed papers highlight the qualities of awareness in human-nonhuman interactions, forming an intra-active assemblage (Deleuze & Guattari, 2013). For instance, O'Brien and Battista (2020) discuss the concept of the "auditory turn," illustrating how choreographers can foster or create intricate relationships within

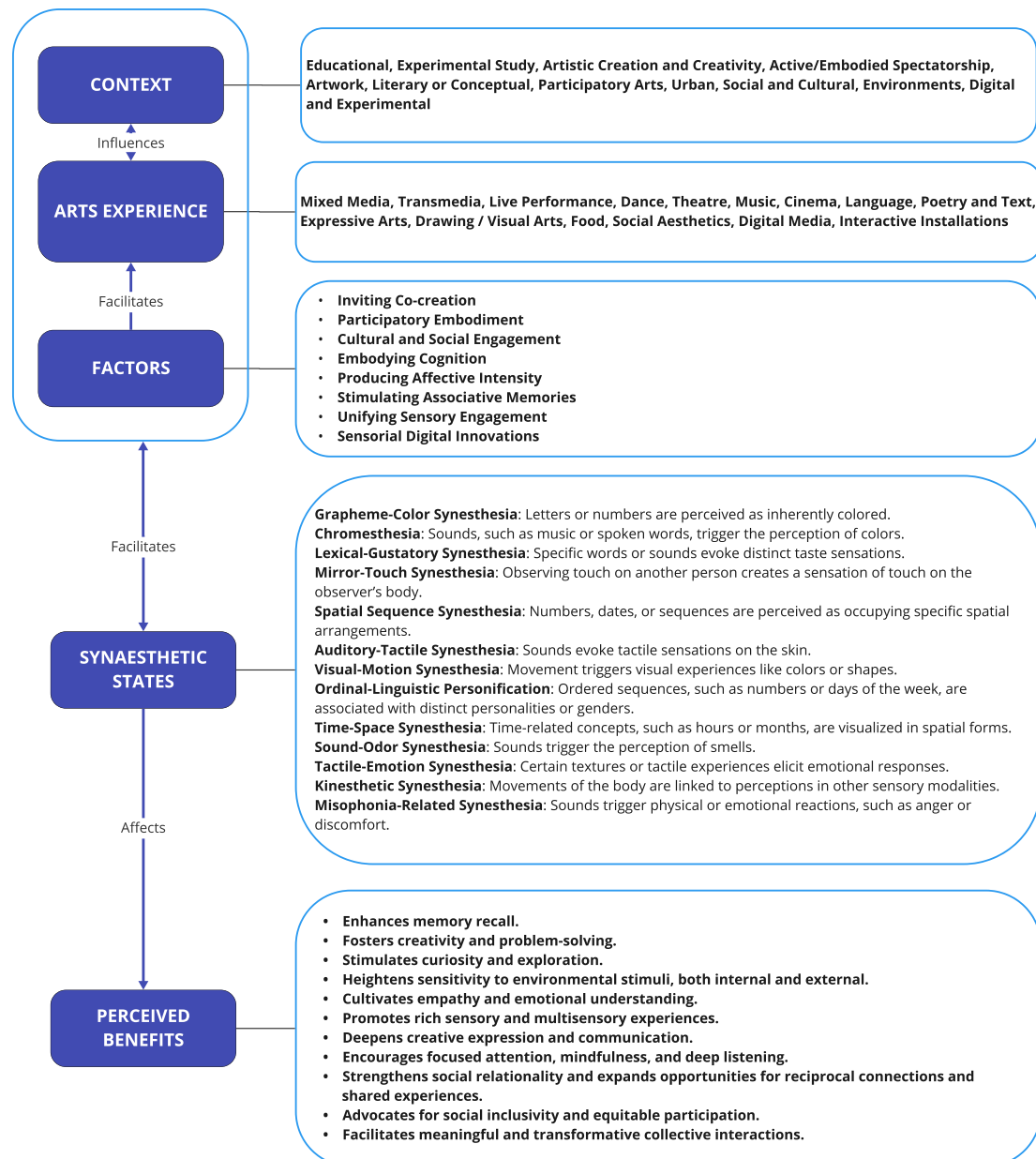


Figure 2. Flowchart of the relationship between elements of the scoping review results illustrating the inter-relatedness of context, arts experience, factors underpinning the experience, synaesthetic states and perceived benefit.

environments that facilitate co-produced synaesthetic experiences. Machon (2009, p. 208) also explores these themes through Churchill's sensual play texts and playwriting,

As a result, Churchill's practice, paradigmatic of (syn)aesthetic playwriting, highlights the embodied exchange that occurs in visceral performance between writer, performer and audience member throughout the process of production, from the initial act of writing to the ongoing process of interpretation.

Again, the art form being Co-created, is described by Kuby (2013) who reflects on affects produced through direct gaze and interaction with certain images drawing the viewer into a dialogue with the arts, where the spectator is an active participant in the transformation of the image into an event. As an example, she explores the images made by Hunter and Carson- two children experiencing racism. Kuby (ibid, p.289), as researcher, shares her experience of viewing the image,

'I could smell the saltiness and moisture from the tears. I could feel the tears rolling down their faces and hear shouts of frustration....Both Hunter and Carson's images demanded interaction from the viewer (Hopperstad,

2010). The way they drew the characters caused them to look directly at us, so to speak. Direct gaze has an impact on the way we come to engage with the content (Hopperstad, 2010) and moves the viewer to have a synaesthetic response.'

According to Machon (2009a) and Kuby (2013) the audience co-creates the synaesthetic event, through sensorial participation, whereby the affective affordances are carried out through the situated practices of the arts expressions. In other words, the aesthetic materiality becomes more than the intended expression when interacted with (Born, 2013), which in the case of Kuby can evoke a direct empathic sensed response that co-creates an emotive, sensorial event.

Participatory embodiment

Participatory Embodiment as a theme, suggests a more-than physical description of sensed states, producing an event that is grounded in cross-modal sensory experiences, describing perception and bodily action, not as distinct events but as co-constitutive.

For example, in the texts, this was evident in the way spectators may experience dance—not as passive observers but as participants in a shared kinetic, embodied and emotional event. The notion of Participatory Embodiment is suggested by the interpretation of dance as inherently informed by a corporeal knowledge that transcends the skills applied.

Understanding this experience as embodied and enactive cognition allows me to make sense of it in an integrated approach. The modelling of the experience in synaesthesia allows me to see it as a merge of sensations, in which both cognitive and bodily processes can be triggered through the modulation of elements which move across senses (Piquero Alvarez, 2020, p. 225).

Piquero Alvarez (2020) notes that synaesthesia is participatory, not passive. Likewise, sound, which is often thought of as being external and auditory, is experienced as an extension of the event through spatial temporality, a matter of vibrations unifying an embodied event where the bodily—synaesthetic and enactive process— is inseparable from the sensation of vibrations, rhythms and movement. In their observations of ballet, Piquero Alvarez, (2020, p. 222) suggests that the perception of sound through mediated arts can transcend its auditory modality, stating that there are,

...synaesthetic possibilities of the relationship(s) between sound and dance. Sound is perceived in the body and often described as being bodily in itself: as light or heavy, as bright or dull or as McGregor describes Richter's music, as 'sitting deep within the body ... You can't help but feel that music in 3D

Furthermore, Alvarez suggests that the spectators sense of embodiment is profoundly activated in the sudden absence of sensorial stimuli, the sensation and attention that extend beyond the perception of movement during its absence, creating a synaesthetic experience through what they referred to as "a void", imbued with heightened emotion.

In a similar way Ryan and Wollan (2013) refer to tourism and festivals, as providing a context for an enacted social embodiment through the expressions of rhythm, liveliness, and dwelling. These events extend beyond being static showcases of cultural artifacts; Ryan and Wollan suggest they are dynamic bodily experiences where the rhythm becomes a shared pulse, and liveliness is felt and reciprocated among participants, thus forming a collective embodied synaesthetic environment.

In conclusion, Participatory Embodiment within the context of synaesthesia fundamentally challenges a traditional Cartesian dualism of mind and body. As the body engages with the multisensory stimuli present in arts, it becomes a conduit for enactive interpretation, enabling a more sensorially interconnected experience.

Cultural and social engagement

As became apparent in the last theme, a cultural and social milieu can produce synaesthetic responses for individuals. The range of texts describing social and interactive events larger than dyadic or small groups suggests that a common context where a synaesthetic experience happens is through some kind of collective gathering. Vogts' (2017) study about the rituals of dining becomes an artistic synaesthetic

practice, invoking taste, sight, smell, and touch, binding people in a shared sensory and cultural narrative, and hence Vogts' theory of synaesthetic perception is deeply rooted in relation to the sociocultural background. Vogts suggests that the ritualised social practices of sharing food speaks through an embodied language entangled within social bonds and collective memories. Further, Barker (2016) suggests that cultural sensory intensities can be produced in cinematic viewings, for example, in Kubrick's 'The Shining,' to evoke a collective unconscious, as a primordial state stimulating synaesthetic capacities by fostering shared cultural and sensory languages.

Ryan and Wollan (2013) also write that festivals and cultural events can produce synaesthetic experiences where aesthetic, social, and symbolic elements coalesce, catalysing a synaesthetic encounter rooted in collective emotionality, cohesion, and diversity.

Lock (2008) addresses the more abstract synaesthetic qualities of cultural arts practices in the composer Braxton's work. For example, Lock suggests the visual figures offer musicians a guide for performance through situated self-discovery, linking personal growth with cultural and historical awareness achieving what Braxton referred to as 'total integration' of sound, colour and movement.

To summarise, 'Cultural and Social Engagement' is a theme that suggests that synaesthetic experiences relate to and are much more likely to be produced within collective cultural contexts.

Embodying cognition

The concept of 'Embodying Cognition' in the context of synaesthesia, within participatory arts, describes an iterative and active cognition that is not only about reprocessing existing physical information as representational but involves an ongoing bodied cognitive response to the arts form. This dynamic interplay integrates sensory and cognitive insights, where perception is actively challenged to produce an undifferentiated sensorial version of events (Filip, 2019).

Barker (2016) suggests that the situatedness of social experience extends beyond the traditional conception of the body. She suggests that the entanglement of the sensory and cognitive is evidenced by participatory arts practices that contemporary media non-synaesthete artists are employing, for example through film. She references Brian Massumi (2002) to explore interpretative strategies of dual mappings in our consciousness—the cognitive combined with visual through the proprioceptive to produce a synaesthetic affect. These mappings, as discussed by Massumi, resist making representations of the world and instead enact sensory-cognitive synergies that engage the full sensorial materiality. Massumi's concept of synaesthesia aligns with an enactive conception of cognition, proposing that our awareness perpetually oscillates between different mappings producing a rupture from the conventional sensorimotor execution, where the proprioceptive cognitive map, often occluded by the dominance of visual cognition, is suddenly made visible and palpable through multi-sensorial engagement with an arts form.

As an example, Banfield (2016) describes a case study of a painter responding to music. The artist states that she 'hears' through her arm as she paints, underscoring that cognition and spatio-visual perception can be cognitively grounded in the body's interpretation of its environment.

In conclusion, Embodying Cognition through the performative reveals synaesthesia as an enacted part of the human experience, becomes a sensory-cognitive entanglement.

Producing affective Intensity

According to the texts, 'Affective Intensity' can give rise to synaesthetic experiences, offering valuable insights into how eliciting and expressing affects intensifies multi-sensorial experience. For example, Standley (2008) states, 'The artist's drive is a corporeally felt impulse that guides the artist as a suggestion of motion' (ibid, 155). She states that such atmospheric qualities, manifest through 'intonation, facial expressions, or gesticulation' (ibid, 155), rather than embellishments; and are integral to understanding and navigating nuanced terrains of human social interactions and that through poetry, synaesthetic characters are produced through atmospheric affective accentuation, lending depth and texture to a given narrative. In this sense affects are defined according to what envelopes and is integral to the synaesthetic situation, for example shared intensified emotions, expressions, social and political contextual

factors. Therefore, this entrainment transcends the individual, harnessing rhythmic and expressive qualities that produces tangible affective intensities, binding the observer and the practitioner in a shared emotional situatedness. Moreover, Standley (*ibid*) suggests that the visual-vestibular correlation with emotional reactivity underscores affective synchrony that relationally aligns emotionally attuned embodied presentations.

Banfield (2016, p. 260) also describes the nonverbal intersubjective affective intensity that can occur between performers' through gestural attunement, engaging the audience in a relational synaesthetic dance.

Translated into their own medium and simultaneously enacted, these rhythmic and expressive qualities generated an affective intensity which was palpable even to me as an observer: I found myself holding my breath. This affective entrainment was sufficiently powerful not only to work across different practices but to extend beyond practice.

Likewise Lock (2008) describes a relationship between external reality and 'the emotion of the artist's soul' expressed through the art work. Here, Lock also suggests that the artist's affects, forms the core of synaesthetic expression, producing an affective experience stimulating the synaesthetic experience. Furthermore, Machon (2009) poses that appreciation of arts must utilise a mode of affective intensity to transform the otherwise non-representational into something affectively palpable, promoting the development of artistic inquiry that employs inter-practice encounters to apprehend and understand somatic affective intensities. She states,

(Syn)aesthetic analysis comes into play where the form and content of the artistic work is executed and received in a way that fuses the somatic ('affecting the body' or 'absorbed through the body') and the semantic (the 'mental reading' of signs) ensuring a double-edged making-sense/sense-making process is affected in interpretation. (*ibid*, 214)

Hunt, also makes reference to the attribution of affects producing synaesthetic states in spiritual contexts of using arts. They suggest that these dynamics facilitate the externalisation of intense emotions producing synaesthetic expressions that resonate with the elemental forces of nature, reflecting a profound relation to an 'otherness' of the physical world for example through shamanic traditions and various forms of nature mysticism. This Hunt (*ibid*) states brings about, 'abstract levels' of cross modal synesthetic capacities (Gendlin, 1978) that underlie felt meaning (Langer, 1972) regarding the presentational symbolisms of the expressive arts (Hunt, 2016, p. 3). Hunt suggests that it is through this lens that non-synaesthetes can experience a complex, textured domain of affective engagement, one where arts are communicated through the affects of the presentation rather than *re-presentation*. Lastly, Probst (2009, p. 230) refers to cross-cultural affects being similar to a Yoryba concept of *ona* stating that,

As such, the power of *ona*/art lies in the way an object or a performance evokes something within us, how it moves us, how it affects our emotions. So far, so good. Yet Drewal's approach aims for more. As he argues, it is not enough to study only our response to form. What is needed is to explore how our senses actually activate form thereby lending agency to it.

In other words, the affordance of affective relations is conceptualised through human-non-human agentive ontologies through being 'moved' by the arts form itself – heightening a sense co-construction with the matters of the art form to evoke affective intensities.

Stimulating associative memories

Stimulating associative memories is often referred to as an integral factor in producing synaesthetic experience where resonances of associations make sense/sense make through the artistic medium. The concept of associative memories has been described by Piquero Alvarez (2020) as a 'resonance' that affects novel perceptions and understanding. With reference to a dance choreographed by Wayne McGregor inspired by the book *Mrs Dalloway* by Virginia Woolf, Alvarez (*ibid*) reflects that the audience is carried through memories and associations as part of producing a multi-modal 'quasi synaesthetic' condition. Alvarez (*ibid*, p. 224) suggests, 'Resonance is, in a way, a form of memory. 'I now, I then' begins

with Woolf's own voice telling us that 'words, English words, are full of echoes, memories, associations.' Temporality and the 'echo' of remembering that Alvarez (ibid) describes in the work, they describe as being heightened by episodic sudden pauses and are designed to produce profound intuitive associations, binding senses in the affective moment. Similarly, Machon (2009) refers to the associative memories that produce synaesthesia in what they refer to as *playwriting* that evokes 'haunting' memories, where the theatrical performance is a live exchange that draws upon and adds to the somatic memories of both performers and audience, emphasising the (syn)aesthetic (parenthesis theirs) nature of live events.

Writing on social food rituals, Vogts (2017) describes the importance of memories as underpinning cultural events, elaborating on the actualisation of episodic memories through her investigations on food,

The union of the senses is not only a metaphor for social wholeness ... it is an embodied aspect of creating the experience of the whole. Food is not a random part that recalls the whole to memory. Its synesthetic qualities, when culturally elaborated ... are an essential ingredient in ritual and everyday experiences of totality. (ibid, 23).

In other words the repetition of the artistic event, either as cultural ritual at a macro level, or in the arts act itself, provides resonances that constitute associations, that are familiarised and synthesised in the moment.

In summary, this theme encapsulates how the activation of embodied and sensory repetitive memories can contribute to the emergence of synaesthesia.

Unifying sensory engagement

Synaesthesia is defined by the lack of differentiation of sensed experience producing a novel percept. Therefore, it is not surprising that all of the texts we reviewed made reference to introducing a range of sensory stimuli simultaneously, sometimes punctuated with absences of stimuli to produce synaesthetic states (Piquero Alvarez, 2020). The theme 'unifying sensory engagement' refers to the synthesis of multiple sensory inputs to produce a synthesised perceptual experience. This theme reflects the idea that in non-synaesthetes, the integration of different sensory modalities can lead to a synaesthetic-like state where one form of sensory input evokes another. In the domain of arts practices and engagement, a multimodal approach is critical to the development of an aesthetic that promotes new insights and knowledges. For example, in the texts explored, Machon (2009) describes textural qualities of music, that associated the qualities of sound to a visual landscape that he called a 'visual chant', Machon (ibid, p. 207) writes,

[Churchill] pares language down to its most basic of sounds. In this way image and sound are semanticized; when performed, the 'meaning' of words are reflected in the sound and feeling they embody as much as in their semantic capability. This enables the individuals in the audience to perceive the details aurally, intellectually, corporeally.

Similarly, Piquero Alvarez, (2020, p. 225) describes synaesthesia in choreography, linking vocalisation with movement, creating a performance that resonates beyond the visual into an assemblage of sensorial experiences.

Freya Vass-Rhee makes use of the idea of synaesthesia when talking about William Forsythe's work and his development of 'a number of innovative choreographic strategies that link vocalisation to the action of dancing.

The bodily-mental presence, along with performative aspects, gain prominence, producing the experience that in dance and movement become inseparable from the sounds and visual rhythms. Whilst this a theme that has been briefly categorically explicated here to introduce salient examples, this factor is implicit within the structures of all of the themes.

Sensorial digital innovations

The intersection of technology with human cognition and perception is evolving into an innovative domain described as '*synaesthetic media*' (Klisanin & Russellville, 2005). These digital advancements

redefine sensory interaction by enabling users to modify and extend the modalities of their sensory inputs, thereby transcending traditional perceptual boundaries. Klisanin and Russellville (2005) describe synaesthetic media as “new media technologies such as multimedia and virtual reality that expand the users’ experience of reality” (ibid p. 44), emphasizing the integration and enhancement of sensory experiences. Additionally, they introduce the concept of ‘*cyberception*’, where transpersonal technology allows individuals to surpass physical perceptual limits, fostering the creation of interconnected communities.

Klisanin and Russellville (ibid) suggest that, based on current prototypes, future technologies may foster forms of collective consciousness, enabling individuals to ‘virtually see with a thousand eyes or hear the subtlest sounds of the earth’ (ibid, p. 55). He argues that the extension of human capabilities is bringing people closer to a synaesthetic experience, whereby technologies extend and blur the boundaries of sensorial domains where perception becomes an integrated, collective, multi-sensorial experience, arguing that such potential of technology will mediate and amplify our sensory experiences to create permeable sensory boundaries between the senses.

Likewise, Machon (2009) places an emphasis the use of technologies to assimilate sensed data but brings our attention to the importance of the corporeal, she suggests Churchill’s playtexts evoke synaesthetic responses in the audience through an ability to,

... encourage inventive interpretation from any practitioner involved in their realization, often demanding a return to the human body as the primary locus of signification fused with imaginative technological experimentation to manifest the ideas and imagery embedded in these texts. (ibid, 2009).

By providing diverse sensory inputs and facilitating their integration, technology can enable a more integrated apprehension of materiality, producing a version of synaesthetic experience. Such developments propose a paradigm shift where technology is not a separate entity but an extension of human multi-modal sensing, suggesting a symbiotic evolution of human perception and technological advancement.

Discussion

In the exploration of sensory integration within non-synaesthetes, it becomes evident that the phenomena do not mimic the exact models of synaesthesia wherein one sensory experience triggers another, with inherent automaticity and consistency. Instead, the reviewed literature describes the production of synaesthetic states in non-synaesthetes as more closely resembling an *integration* of senses. Such integration, whilst structurally different from that of synaesthetes, potentially offers benefits by enhancing emotional and context-sensitive awareness, which enriches interpersonal understanding and communication. It is important to note that the literature suggests that the relationship between the factors identified to facilitate synaesthesia, and the emergence of the synaesthesia-like states occur in a non-linear way (Golańska, 2020, Massumi, 2002) and as such the causal relationship should be considered with caution. Whilst the identified factors appear to be interrelated discrete entities, it is also observed that synesthesia has a bi-directional propensity to produce these factors as a kind of snowball effect, as well as having the capacity to be produced by a combination of the identified factors.

Further, this study specifically narrowed its focus to socially-oriented interactions—such as those occurring within communal groups, between artists and spectators, and between researchers and subjects. In each instance, an increase in the depth and clarity of meaningful emotional awareness was observed, suggesting new ways to conceptualise synaesthesia and its facilitation through the arts. It is also notable that there is evidence highlighting the significant prevalence of synaesthetic abilities among artists (Domino, 1989; Mulvenna, 2007; Rothen & Meier, 2010) and the findings of this review align with these scientific perspectives, suggesting a pronounced correlation between synaesthesia, artistic creativity, and enhanced perceptual changes that can deepen social connections and interactions.

To expand, the review’s insights lead to two pivotal observations. First, the synaesthetic responses described in the literature, related to artistic contexts, do not strictly adhere to traditional definitions of synaesthesia but rather represent a broader spectrum of sensory integration. These manifestations may not qualify as synaesthetic in the strictest clinical sense but still encompass significant sensory and cognitive integrations that use similar mechanisms as synaesthetic experiences. Second, these synaesthetic-like

states play a crucial role in facilitating communication, heightening awareness, and enriching the quality of social interactions. According to the literature reviewed, such states enable individuals to experience and share enhanced sensory and emotional perceptions that can provide a depth of novel engagement through everyday interactions and artistic expressions.

Collectively, these points underscore the importance of recognising the broader implications of synaesthetic experiences and their potential to transcend beyond the individual to have profound impacts on social intra-actions. By acknowledging and exploring these insights, future research could further investigate the relationship between synaesthesia, sensory integration, and their expansive role in developing a range of proposed benefits, including enhanced memory, creativity, curiosity, sensitivity to stimuli, empathy, enriching sensory experiences and deepening communication, as well as promoting mindfulness and strengthening social connections.

Limitations

The limitations of this scoping review are intrinsic to its exploratory methodology and the diversity of the sources it incorporates. First, the nature of the scoping review precludes the inclusion of quantitative data, which could offer more robust evidence for the relationships between the eight identified themes and the emergence of synaesthetic states. While the review maps a broad array of themes and contexts, it does not provide the level of evidence typically derived from systematic reviews or experimental studies. This limitation highlights the need for future research to quantitatively test and refine these relationships.

Additionally, the scope of the review was shaped by its focus on arts and socially oriented contexts, such as culinary artistry, dance, theatrical performance, arts-based research, and the dynamic interactions between performers and audiences, as well as researchers and participants. While this approach provides a rich contextual understanding, it may not fully encompass the broader spectrum of synaesthetic experiences possible in non-arts settings or under different conditions. However, given the alignment of synaesthesia with creative states, the insights gained here may have relevance beyond the contexts studied.

The quality of the literature included in the review also varied significantly, ranging from rigorously peer-reviewed articles to less formally evaluated materials such as a thesis and other grey literature. This variability could affect the reliability and consistency of the findings. Nevertheless, the inclusion of diverse perspectives, particularly from arts-based contexts, contributes to a more nuanced understanding of synaesthesia, emphasizing its experiential and creative dimensions.

The interdependent nature of the eight themes identified in the review presents another challenge. These themes, while conceptually distinct, exhibit significant overlap, making it difficult to isolate individual factors. This interconnectedness underscores the complexity of synaesthetic experiences and suggests that these themes should be understood as part of a larger, dynamic network of influences rather than as discrete elements.

Another limitation arises from the absence of research directly linking the identified themes to medical or neurological research on synaesthesia. While such evidence would provide valuable insights, no studies to date have explored these intersections comprehensively. Furthermore, a purely evidence-based or quantitative approach might fail to capture the full complexity of the synaesthetic factors revealed through the arts-focused lens of this review.

The research team's unique composition—a synaesthete and a non-synaesthete, both professionals in arts and health—also influenced the findings. This multidisciplinary perspective enriched the analysis with theoretical and practical insights but may also introduce interpretative biases reflective of the team's expertise.

Finally, the thematic structure of the review reflects the interrelatedness of the identified factors. Rather than treating each theme as a standalone concept, the findings suggest that these themes operate in concert, creating a complex and interconnected framework. While this approach deepens the understanding of synaesthetic experiences, it complicates the isolation of single factors for targeted analysis.

This review has sought to elucidate synaesthetic mechanisms and experiences in non-synaesthetes facilitated through the arts in relational contexts. By focusing on the nuances of synaesthetic experiences and their broader implications within social contexts, the review has illuminated potential pathways through which synaesthesia may confer evolutionary advantages, enhance interpersonal connections, and foster a deeper understanding of multisensory integration.

The exploration within this review has primarily revealed that while traditional synaesthesia involves distinct and involuntary sensory cross-activation, the synaesthetic-like experiences in non-synaesthetes can also result in an integrated and conscious appreciation of multisensory inputs. These experiences, although not synaesthetic in the usual sense, mimic the integrative nature of synaesthesia and offer similar cognitive and perceptual enhancements. This insight challenges and expands the conventional understanding of synaesthesia beyond its clinical boundaries, suggesting a spectrum of synaesthetic-like capacities that could contribute to human cognitive diversity and sensory richness.

Furthermore, the review underscores the significant role of the arts in cultivating these synaesthetic states. The arts provide a unique platform where sensory modalities can converge and interact, thereby serving as a catalyst for synaesthetic experiences among non-synaesthetes. This relationship not only highlights the intrinsic value of the arts in human culture but also their potential to unlock new forms of sensory and emotional communication. By participating with the arts, individuals may tap into the latent synaesthetic capabilities that enhance the way they perceive and relate to the world around them.

This review has important implications for educational practices, therapeutic interventions, and cognitive research. In education, applying insights from synaesthesia research can lead to more effective and inclusive learning strategies that accommodate diverse sensory processing styles. In therapy, understanding synaesthetic processes can inform new approaches to sensory integration therapies, potentially benefiting individuals with sensory processing disorders to help social connectedness, psychological flexibility and relational awareness. In cognitive science, expanding the study of synaesthesia to include non-clinical populations could provide valuable insights into the neurobiological underpinnings of sensory perception and cognitive integration.

Further research in this area is needed to identify the optimal combinations of factors that evoke and intensify synaesthetic experiences. This research could help to refine the concepts of multisensory, immersive, and inclusive art, offering insight into what factors play a part and when they occur during participations with the arts.

Conclusion

In conclusion, while traditional views of synaesthesia have focused on neurological and developmental causes to explain what synaesthesia is, this review proposes a broader conceptualisation that recognises synaesthetic experiences as a valuable contribution to human cognitive and cultural development. These experiences, particularly when facilitated by engagement with the arts, appear to enhance our sensory acuity and cognitive flexibility, enrich our interactions, and deepen our connections to the world. Future research should continue to explore these integrative sensory experiences, furthering our understanding of their mechanisms, their evolutionary advantages, and their potential to enrich human life in a range of ways.

About the author

Professor Dominik Havsteen-Franklin is an internationally recognised scholar in arts and health, specialising in arts therapies, resilience, and creative methodologies in crisis scenarios. He researches arts-based practices in mental health, education, and team development.

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No potential conflict of interest was reported by the authors.

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