

Conserving a sense of self despite significantly impaired short-term memory through songwriting and formative events

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Abstract

This case study reflects on the use of improvisation and songwriting to support a patient with significantly impaired short-term memory and long-term memory interference as a result of acquired brain injury. Memory has long been associated with personal identity, linking the past with the present, and enabling us to project into the future. This continuity of consciousness helps us to learn from, and make sense of our experiences, strengthening our internal representation of self. Disruption to short-term memory can significantly impact decision making, planning and initiation, all of which are key components of personal identity and self-expression. Supporting patient autonomy and self-expression through improvisation, and crafting lyrical content around personal preferences and events, sessions were designed to bolster his internalised sense of self through both revisiting old memories and facilitating new memory formation within the present. While short-term memory has been considered a conduit to long-term memory consolidation, and integral to the individual's self-expression, this case study implies short-term memory was neither the gatekeeper to formation of long-term memories, nor critical to maintaining a sense of self, and reflects on how music helped the client create and access new learning beyond procedural memories, anchoring the self in newly internalised self-expression.

Keywords

acquired brain injury; music therapy; neurodisability; personal identity; rehabilitation; short-term memory

Background

Shortly after starting his university studies, C.M.¹ was diagnosed with a rare cancer; he was not yet 20 years old. Within a year, his cancer had progressed with metastases to his lungs and brain. After 3 years and several cycles of chemotherapy, radiotherapy and multiple surgeries, including neuro-surgical removal of tumours from both the right frontal and left temporal lobes, C.M. was admitted onto a specialist long-term care facility for palliative care.

Soft spoken, amiable and polite, C.M. was easy to spend time with. His mood was typically bright and euthymic. He had a wry sense of humour and could sing *Oasis* songs with a panache that even Liam Gallagher would be impressed with. He was passionate about sports, diligently wearing tracksuit and trainers, and he followed the games of his favourite football team. Football posters hung on his wall along with a soft dartboard and a set of golf clubs propped in the corner of the room.

But C.M.'s charm and wit masked significant global cognitive deficits. His ability to understand and use language, as well as his ability to read and write, appeared intact; his speech was fluent and normal in volume. Phatic responses and backchannel gestures² encouraged the speaker to continue, but as sentence length and complexity increased, C.M.'s comprehension would break down; after a few minutes, he would forget what had been said all together. C.M.'s short-term memory was severely impaired, negatively impacting his functional communication, decision making, problem solving, memory consolidation and retrieval processes—all of which have significant bearing on personal identity and maintaining a coherent sense of self.

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Memory and self-identity

Memory has long been associated with personal identity and an individual's sense of self. In his philosophical paper, *An Essay Concerning Human Understanding* (1690), Locke proposed memory—comprised of sensory and reflective systems—plays a crucial role in shaping one's understanding of oneself, connecting the present self with the past self to provide a 'continuity of consciousness'. Without memory, the connection between our past and present selves would be lost.

New experiences are integrated into our existing knowledge base through a continuous cycle and ongoing retrieval of autobiographical memories, comparing and contrasting information in order to help construct our unique life story (Rousell, 2007). Current self-views, beliefs and goals not only influence the recollection and appraisal of the former self, they will be influenced by what we remember about our personal past, as well as how we recall earlier selves and events. These reconstructed memories continually reinforce, revise and shape our internal representation of who we are and who we hope to become. The transformation of a belief or self-assessment will trigger new emotional and cognitive responses to experiences and environmental stimuli, heightening self-efficacy, confidence and self-esteem, guiding our thoughts and beliefs, decisions, problem solving and self-regulation within the present and future (Bisaz et al., 2014).

What makes memories stick?

Memory is often considered in terms of short-term memory (STM) and long-term memory (LTM) (James, 1890), and the 'modal model' of memory presents STM as a gateway for the formation of LTM representations (Atkinson and Shiffrin, 1968; Camina and Güell, 2017). STM holds a small, limited, amount of information for a finite period of time in an active, readily available state in order to evaluate and respond to the environment; short-term 'working memory' is used to perform the more complex tasks of processing linguistic and verbal information (Martin, 1993), as well as learning and reasoning (Baddeley and Hitch, 1974). There is virtually no task that can be completed without the involvement of STM, making it a critical component of cognition.

Located in the medial temporal lobes, the hippocampus plays a crucial role in the processing and interpretation of sensory input, affect/emotions, understanding language, and object recognition as well as the formation of new memories, consolidation into long-term storage, and retrieval. The left hippocampus is associated with the formation of new verbal memories, while the right temporal lobe interprets and forms memories of non-verbal and visual information, for example, music, sounds and visual-spatial information (Ho et al., 2003; Moss, 2016).

Memory consolidation typically takes place within the first minutes or hours of learning and is reliant on the coordinated functioning of different brain regions (e.g. hippocampus, amygdala, prefrontal cortex), along with the release of various neurotransmitters (e.g. epinephrine, dopamine, serotonin, acetylcholine and glutamate) and hormones (Myhrer, 2003) during which cellular and molecular changes to neurons occur. Increased activity in the parietal and occipital lobes, perirhinal, temporal pole and parts of lateral parietal cortex has been observed during the formation of semantic memories, whereas procedural, sensory memory and motor skills are performed automatically by a variety of modality-specific brain

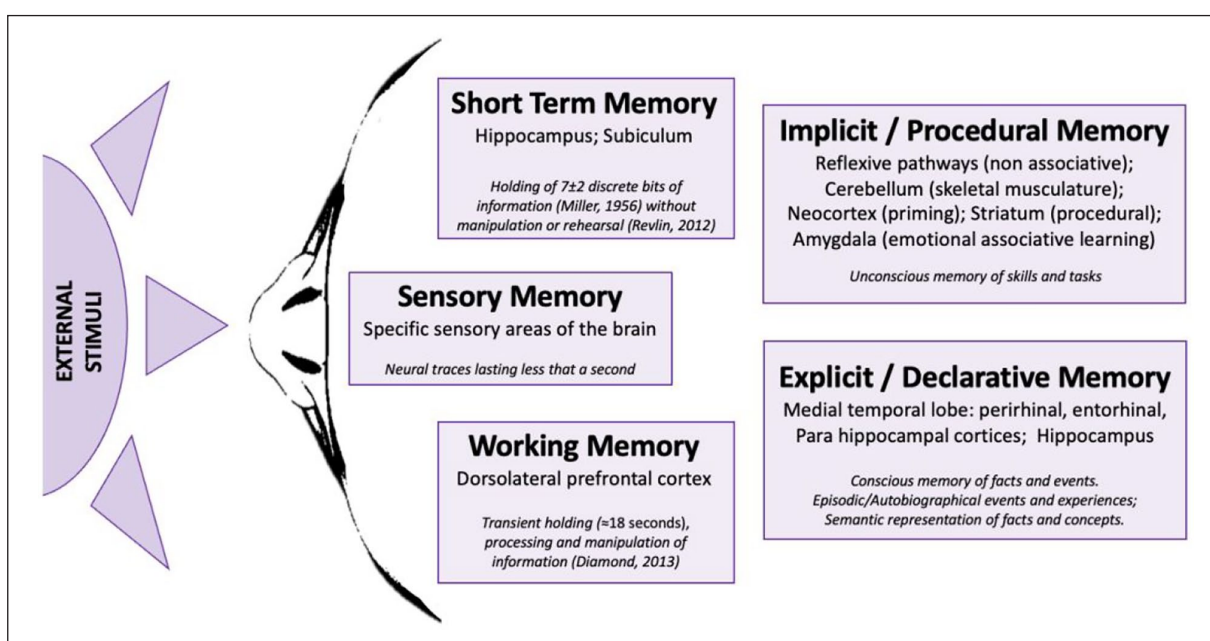


Figure 1. (Thorpe, 2024) Types of memory and associated brain structures.

areas (Camina and Güell, 2017; Tulving and Markowitsch, 1998). The hippocampal networks appear to act as an ‘associative device’ (Moss, 2016), bringing various bits of stored information together in a coherent and meaningful recollection of specific personal experiences (Tulving and Markowitsch, 1998) while accessing musical semantic memory occurs bilaterally in the temporal and pre-frontal lobes (Taylor, 2010: 103).

Repetition is one way whereby information is converted from short-term memory into long-term memory through altered gene expression and the growth of new synaptic connections (Kandel, 2007). Novel, but familiar, experiences prompt an increased release of neurotransmitters and dopamine optimising memory consolidation (Damasio, 2011), and distinctly novel experience will, in addition, activate noradrenergic neurons in the locus coeruleus, triggering even stronger initial memory consolidation resulting in vivid and long-lasting episodic memories (Duszkiewicz et al., 2019). Further increased release of neurotransmitters and hormones was observed in highly emotional situations, and this observation led to the ‘arousal theory’ of memory suggesting strong emotional experiences result in stronger memory formation (Christianson, 1992). This theory was further supported with identified increases in glutamate that consolidate the memory of a stressful event (McGaugh, 2013).

Memory rehabilitation

Memory impairment is the most common cognitive deficit reported by people with traumatic brain injuries (TBIs), affecting 40% to 60% of patients (das Nair et al., 2015); more than 90% of people with brain tumours experience problems with memory, attention and executive functioning. This causes significant difficulties in activities of daily living, social participation and overall quality of life (Coomans et al., 2019; Fish et al., 2008). Gracey et al. (2008) identified ‘loss of self’ and ‘self-discrepancy’ (between actual and pre-injury selves) as key concerns in how people construe themselves following brain injury. Consistent with social identity theory (Tajfel et al., 1979), following brain injury, individuals often rely on the felt experiences of social and practical activities to make sense of themselves. Functionally oriented rehabilitation programmes, for example, Behavioural Activation (Damasio, 2011), aim to improve mood and overall functioning by focusing on engagement in behaviours that ‘activate’ pleasant emotions, creating positive reinforcement. Activities relating to belonging and capability that ‘reinforce who I am’, as well as help the individual to ‘feel part of things’, have been shown to positively impact rehabilitation outcomes (Gracey et al., 2008).

Music and music therapy

Music is often intertwined with personal identity. Preferred songs from formative years hold increased emotional significance and can often be quickly recalled from nominal information due to a reminiscence bump in autobiographical memory (Renwick and Woolhouse, 2023). By listening to or creating music from their past, individuals may be able to recall more personal information (Bradt, 2010; Hauck, 2013), as well as memories and experiences that help them reconnect with their sense of self (Cuddy et al., 2015).

Music is also an intrinsically rewarding stimulus, activating brain regions involved in reward, motivation, emotion and arousal (Blood and Zatorre, 2001). No one hemisphere or anatomical structure has been identified for music processing. In fact, a review of cortical changes during music interventions has indicated the activation of bilateral networks across the frontal, temporal and parietal lobes, cerebellum and limbic areas, successfully stimulating attention, working and reference memory, motor functions, semantic cognitive processing, emotional processes and self-awareness (Särkämö et al., 2008). Music training has also been shown to systematically affect memory processing and improve verbal memory in children, along with neuroanatomical alterations in the left temporal lobe (Ho et al., 2003). As such, music is ubiquitous in early learning programmes, and many types of therapies, including speech and language, physical and psychological therapies, use music to support active participation, movement and speech, and to enhance overall engagement in more effective perceptual and cognitive processing (Taylor, 2010).

Within the United Kingdom, music therapy is an established psychological clinical intervention, delivered by Health and Care Professions Council (HCPC) registered Music Therapists ‘to help people whose lives have been affected by injury, illness or disability through supporting their psychological, emotional, cognitive, physical, communicative and social needs’ (British Association for Music Therapy, 2024). The postgraduate training, informed by psychodynamic theory, considers non-verbal communication through the application of different elements of music, for example, rhythm, melody and tonality, within a therapeutic relationship. With the advancement of neuro-imaging and the increased scientific understanding of the effects of music perception and production on non-musical brain and behaviour functions, specific Neurologic Music Therapy (NMT) methods and techniques were developed (Thaut and Hoemberg, 2014). NMT focuses on the application of musical elements to stimulate and improve function across cognitive, motor and speech domains through a range of techniques, for example, Pattern Sensory Enhancement (PSA), Rhythmic Auditory Stimulation (RAS), Musical Mnemonics Training (MMT) and Attention Control Training (MACT) (Thaut and Hoemberg, 2014). Similarly, the Bio-Medical Model of Music Therapy aims to assist patients in ‘acquiring and utilising the maximum capabilities of their brains in processing new information as it is received from the environment’ through the use of music stimuli (Taylor, 2010: 40).

Expressive and creative writing is used across various psychotherapies—including more recently, Acceptance and Commitment Therapy (ACT; Ruini and Mortara, 2021)—for its beneficial effects on physical and psychological health. Similar to Writing Therapy³, songwriting can help the client process thoughts, emotions and life situations not only through word play but also through musical expression opening a variety of pathways to reflection and positive change. Therapeutic songwriting, defined as ‘the process of creating, notating, and/or recording lyrics and music by the client[s] and therapist within a therapeutic relationship to address psychosocial, emotional, cognitive and communication needs of the client’ (Baker and Wigram, 2005: 16), is a versatile technique that can be used to buoy a range of cognitive functions including planning and organisation (Thaut and Hoemberg, 2014), while also addressing mood, identity reconstruction and emotional expression in neurorehabilitation (Magee et al., 2017).

From theoretical abstraction to practical implementation, the following case study illuminates how songwriting was integrated into clinical practice and the many different ways it supported a man with profound STM deficits.

Case study

C.M. had been diagnosed with a rare cancer when he was 19 years old. Within 9 months, the cancer had metastasized and he required an emergency craniotomy to remove one small and one large deep left frontal intraventricular tumour. He required further surgery to remove a right temporal haematoma and uncal herniation. After additional radiotherapy, C.M. was admitted to a specialist long-term care unit for palliative care.

While C.M. could make simple and immediate everyday decisions (e.g. what he wanted to wear or eat), he was unlikely to initiate action. His physical fatigue and memory dysfunction manifested in reduced insight, reduced attention and lack of initiation. He rarely initiated communication, required significant support to engage in activities. Without support, he was more likely to spend a significant amount of time in bed. Despite this, C.M. did not report low mood or anxiety, consistently rating his mood as a ‘good’, 7/10.

To support the multidisciplinary team (MDT) goals around quality of life and proactive engagement, C.M. was referred for individual music therapy sessions. Over the course of 9 months, C.M. received 20 individual music therapy sessions. This was followed by 6 months of access to a weekly open music group, then an additional 3 months of individual sessions. A total of 30 individual sessions were held. Interventions and theoretical models used were based on the therapist’s training and clinical reasoning, and included psychodynamic music therapy for neurorehabilitation (Baker and Tamplin, 2006) and NMT techniques (Thaut and Hoemberg, 2014).

C.M. was often in bed when I arrived having forgotten about our scheduled session. Initially, he would decline sessions, saying that he was tired, or that he ‘wasn’t any good at music’. When reminded that he had enjoyed the session the week before, he would express some surprise, then say that he would be willing to ‘try’ and would get up. Over time, C.M. began to remember me and my name; he stopped declining sessions and was ready to engage in a range of activities. To bolster mobility and orientation goals, we began to hold our sessions off the ward, walking across the hospital grounds to the music therapy treatment room where we also had access to a greater range of instruments.

Sessions focused on increasing C.M.’s social engagement, self-expression and autonomy through the singing of, and reflection around, preferred songs. This approach was used to evoke memories, emotions and experiences helping C.M. reconnect with his past sense of self. When asked what he would like to do, C.M. would invariably shrug and respond, ‘I don’t know’ or ‘I don’t mind’. Encouraged to elaborate, he would appear indifferent, but if presented with absurd choices (e.g. Would you like to sing a French Folk song, or an *Oasis* song?), he would make a declarative statement. Options were presented on an ongoing basis to facilitate decision making and support C.M. in demonstrating his personal preferences. C.M. derived significant pleasure from singing preferred songs for which he could recall many lyrics. He presented with a moderate vocal range, volume and breath control. He would engage for approximately 35 minutes before fatiguing.

At the beginning and end of each session, I asked C.M. to rate his mood on a scale of 1 to 10. He consistently responded with ‘Good, 7/10’ at the beginning of the session, in alignment with his response to this question in different contexts. At the end of the sessions, he provided a consistent ‘Good, 9/10’. When asked to say what he had enjoyed most about a session, he would smile, shrug and say, ‘I don’t know; I can’t remember’, nor could he recall the rating he had given at the beginning of the session. However, the consistent shift in ratings suggested that C.M. had internalised a positive and fulfilling experience.

Re-finding something old, creating something new

With ‘scaffolding’⁴ C.M. could recall information about his life and personal preferences though he struggled to frame memories in a narrative form. When I suggested that we write some songs to capture his personal stories and memories, he appeared bemused, but receptive to the idea; when asked what he would like to write about, he would respond, ‘I don’t know’.

The reason to use songwriting with C.M. was multifaceted. Similar to writing therapy and ‘self imagination’ techniques (Grilli and Glisky, 2010), songwriting can be used as a means to express and reflect on and imagine oneself. However, musical expression is not dependent on words; but with words, a song could provide an accessible vehicle for frequent rehearsal and review.

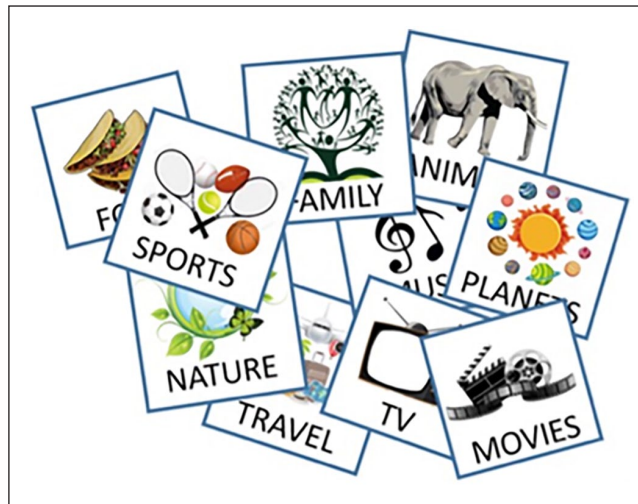


Figure 2. Visual Aid–Topics.

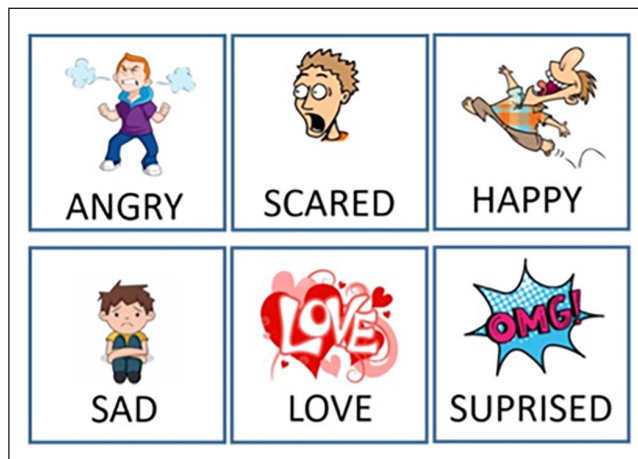


Figure 3. Visual Aid–Emotions.

Through musical expression, C.M. was able to generate novel ideas, facilitating subliminal decision making and self-expression, then through supported reflection we explored different ways to describe the experience, autobiographical memories, personal preferences and attending to the moment. This work also required review of lyrics and content organisation as we worked through the writing process to create the final song. While C.M. was unable to proactively initiate content creation, using a range of writing techniques, the resultant songs captured components of his self-identity in a form that he could then revisit and actively experience again and again. The song structure of verse and chorus provided a framework for the narrative that C.M. could positively engage with. While C.M. was unable to recall what we had done from session to session, or what we had done within a session, what became apparent was his ability to sing the new and novel songs that we had created together, suggesting that lyrical and melodic content had formed a new and retrievable memory. Sessions evolved to create an audio body of work around meaningful moments and memories that he could access on an ongoing basis.

Song parody: Out on the Golf Course

To facilitate the songwriting process, for our first song, C.M. was invited to select a theme (sports/golfing) and mood (happy) from a range of visual cue card choices (Figures 2 and 3). I then asked a range of questions to help C.M. re-imagine his time out on the golf course—who did he play with, what time of day did he prefer to play, what would he do after a game. We outlined his hand on a blank piece of paper and captured the main theme in the palm. Ideas for the verses (e.g. chronological activities for the beginning, middle and end of a story) were identified on each finger (Figure 4). This active engagement device provided a visual representation of the song structure that could be referred back to by looking at the paper or by his using his fingers as story cues.

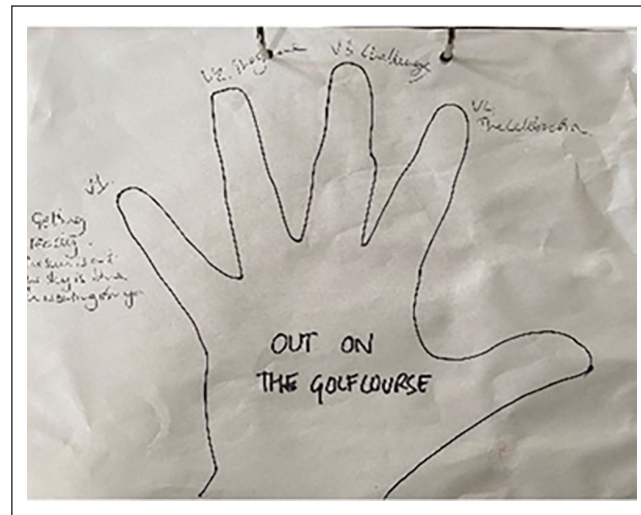


Figure 4. Visual Aid—Hand drawing.

Figure 5. Song Parody—Out On the Golf Course.

Using a chord structure, tempo and rhythm akin to a preferred song, I then sang different phrases and built on the lines he picked-up on and echoed (Figure 5). For further inspiration, we searched for ‘common golf terms’ on the Internet and incorporated them into the lyrics.

Starting with lyrical content: (*Dreaming of Barcelona; Football; White Christmas*)

After C.M. had identified a theme or event (e.g. a family holiday in Spain; going to a football match), I would ask him about the topic and then draft some lyrics Figure 6. We then listened to thematically related music (e.g. traditional Spanish music, football chants) and then I presented music options to support the emotional expression of the drafted lyrics for him to select. To support attention and awareness, I asked C.M. to describe what he observed around him, whether looking out of the window, walking outside or noticing the decorations on the ward and from these observations, we created lyrics (e.g. White Christmas).

Starting from musical improvisation: (*It’s a Lovely Day; I don’t know*)

I would invite C.M. to select from a range of instruments (e.g. bass xylophone, drums, chime bars or piano) and then wait for him to start playing the chosen instrument. Using empathetic improvisation methods, including mirroring and matching, I would follow his tempo, rhythms and note choices, building a harmonic structure and movement through different chord sequences. This framed the musical idea allowing us to explore different elements and dynamics while developing a musical dialogue. Responding to the mood and affect of C.M.’s improvisation, I would begin to integrate words and ideas from our conversations while walking to the treatment room. He appeared to show some awareness of this connection, smiling, laughing or echoing certain phrases that appeared to resonate with him, that I would then elaborate on. Initially, C.M.’s playing was rigid with straight rhythms (e.g. crotchets), and linear melodic sequences (moving up/down the keys).

C.M.: <i>Dreaming of Barcelona</i>	C.M.: <i>Football</i>	C.M.: <i>White Christmas</i>
Dreaming of Barcelona Traveling free Dreaming of Barcelona and the golden sandy beach It's so delightful It just makes me smile Dreaming of Barcelona walking through the streets Checking out the señoritas Chasing bulls down the street They should have been in the ring The streets were running wild And when I was there I got myself an ice cream It really was delightful. It just makes me smile Heading to the beach The sun was beating down The sand was hot, the sea called out So I went to the water's edge And it was cool, yes it was cool It was so so cool And that's when I found you. I swam around and around And the sun kept beating down And I thought that I might have found a way to fly	Feeling so happy as I head to the grounds Watching the players warming up As they run around Blue 'n yellow, the 'dons are back in town I just love to hear the roar of the crowd la la la La LA la la la La LA la la la La LA Football The blow of the whistle the game begins The ball passed around The opposition intervenes Don't think for a second that the 'dons will let this be They are coming back to take it away, just you wait and see, la la la La LA . . . etc Football It's half time now The scores is 3-nil I feel sure we're gonna win the game But you never really know until the final whistle blows And the crowd is roaring once again la la la La LA . . . etc Football	I don't want a white Christmas I don't want a white Christmas I'd rather be somewhere in the sun. I don't need a white Christmas I don't need a white Christmas I don't need the snow to have some fun. I don't need a load of presents, Underneath the tree I just want to be with you, And wish you a merry Christmas, I love you It's getting cold outside, nah, I'm really not a fan Of the jumpers, hats n scarves, The gloves 'n boots I don't care for the mountains of food That we're meant to eat The turkey, parsnips, sprouts, 'n cranberry sauce It doesn't make much difference if there are fairy lights in the street Christmas trees and decorations shops bursting at the seams Everyone's going crazy trying to score a deal in tinsel town Buy buy buy on Black Friday, Cyber Monday too Shoppers going mad with plastic cash But there nothing that I need that will make it more special for me Than spending my Christmas with you

Figure 6. Starting with lyrical content.

Over time, C.M.'s playing became more flexible as he responded to modelled playfulness, with him initially copying, then initiating different rhythms or playing non-linear melodies.

Emotional exploration: Thinking of You

When asked about feeling states, C.M.'s responses were characteristically ambiguous and if asked to explore an emotion or a feeling towards an event or an individual, he would struggle to respond. His default answer to open-ended question was 'I don't know', though he was fairly confident in responding to concrete questions with options, for example, when asked 'Would you like to write an angry/sad song?' he would wrinkle his nose and say, 'no'.

In two sessions, C.M. conveyed some sadness regarding some personal situations; when I sang more emotional or reflective lyrics, he appeared to lose interest and stopped singing along. When explored, he conveyed some confusion and became frustrated. While this could indicate an emotional and defensive response worthy of further exploration, due to the MDT use of a positive BA strategy, these song fragments were not pursued. Improvisations were guided through a range of chords to resolve with positive expression. All song lyrics were typed up and physically kept in a folder in C.M.'s room where he could share with his psychologist for further reflection.

Extending the work

In subsequent sessions, C.M. was able to recall the melody and lyrics of the songs we had written, demonstrating new learning of novel material. His pleasure in singing these songs was palpable, and we developed a plan to facilitate C.M. recording his songs in a professional calibre recording studio. While supporting MDT goals of facilitating off-site activities for C.M., this programme was also designed to create a unique formative event (Pinker, 2003) with the hope of reinforcing the consolidation of a new and pleasurable memory, and bolstering his sense of self. To assist in the endeavour, C.M. and I visited the Leisure & Family Services department to request a financial contribution to support the recording of two songs, which was subsequently approved.

C.M. was supported by the MDT to engage with task-planning, organisation and sequencing of events, and singing practice. Review of travel routes, time considerations, and food and drink requirements helped C.M. reflect on his own personal needs (e.g. medicines, fatigue or hunger). Pre-production efforts included review and finalisation of the lyrics with C.M., and the creation of backing tracks with a guide vocal created by the therapist with the studio engineer. Tracks were shared with C.M. so that he could practice.

C.M. travelled 40 minutes to the studio where he recorded vocal tracks for two songs. He developed an immediate rapport with the engineer, laughing and smiling, engaging in banter. Despite feeling tired, he continued to sing for over an hour before taking a break. Listening back to the tracks, he expressed surprise and pride in the songs. When asked to describe his experience and his thoughts about the songs, he commented 'wicked'. After he left the studio, the songs were mixed and finalised. To conclude, I created videos for the songs, incorporating footage of the studio experience that C.M. could then share with his family and friends.

Final reflections

Although the impact of persistent cognitive dysfunction on the individual's senses of self (plural intended) is not fully understood, this case study implies that C.M.'s STM impairment neither prohibited the formation nor retrieval of new implicit memories, for example his navigating the hospital and recalling song lyrics, nor did it strip him of his ability to express himself. Musical improvisation facilitated self-expression and communication with a freedom that was not possible through traditional communication, and it provided C.M. a way to express himself with a freedom and fluency that was not possible through verbal communication. Improvisations noticeably increased in length, with increased musical flexibility in his responsiveness and his use of rhythm, melody and tempo. Reinforced with personalised lyrics with the intention of bolstering his sense of self, C.M. was able to create and hold on to a new and present self-expression. The recorded songs fostered a sense of accomplishment and provided a tangible artefact that could be easily revisited. While C.M. may continue to struggle initiating access to his songs, with help, he can listen to and immediately sing the songs.

While his motivation and engagement with tasks continued to vary on a daily basis, often linked to his physical health, once engaged, C.M. enjoyed participating and he contributed to activities with increased confidence and autonomy. He began to demonstrate insight into his limitations and in independently communicating his needs for support within the ward environment. C.M. became more vocal in expressing worry and uncertainty about the future, opening the door for further exploration with him of more emotional aspects. With normalised tumour markers and his stabilised condition, team efforts shifted to finding another more appropriate environment for C.M. to continue to engage with meaningful social activities. This was achieved and C.M. successfully moved to a step-down supported living environment.

This case study suggests that the musical framework facilitated retrieval of novel content; however, further controlled studies would be required to explore the saliency of the songwriting and identify the specific mechanisms impacting memory consolidation as well as its impact on personal identity and sense of continuity of self.

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Author contributions

Amanda J Thorpe: Literature Review, Formulation, Original draft preparation, Editing and Final manuscript review.

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Informed consent

Written informed consent was obtained from the patient and family members to publish this paper.

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Data availability statement

The song recordings and lyrics generated during and/or analysed during the current case study are not publicly available due to them containing information that could compromise C.M.'s privacy/consent but are available from the corresponding author on reasonable request.

Notes

1. Client initials have been used to preserve client confidentiality.
2. 'Backchannel' refers to active participation of the listener who contributes to the back and forth of conversation with short messages such as 'yes' and 'uh-huh' without assuming the turn (Yngve, 1970).
3. Social psychologist James Pennebaker was a leading advocate and researcher of Writing Therapy in the 1980s. His research focused on the benefits of writing about one's emotional disturbances, including reduced stress and improved immune function, helping to propel writing therapy into the mainstream of psychotherapeutic practice.
4. 'Scaffolding' refers to a supportive structure that assists the individual in their cognitive or behavioural learning or rehabilitation. It was defined by Wood et al. (1976), in a paper titled, *The Role of Tutoring in Problem Solving* as 'a process that enables a child or novice to solve a task or achieve a goal that would be beyond his unassisted efforts'.

References

- Atkinson RC and Shiffrin RM (1968) Human memory: A proposed system and its control processes. *Psychology of Learning and Motivation: Advances in Research and Theory* 2: 89–195.
- Baddeley A and Hitch G (1974) Working memory. *Psychology of Learning and Motivation* 8: 47–89.
- Baker F and Wigram T (2005) *Songwriting: Methods, Techniques and Clinical Applications for Music Therapy Clinicians, Educators and Students*. Philadelphia, PA: Jessica Kingsley Publishers.
- Baker F and Tamplin J (2006) *Music Therapy Methods in Neuro-Rehabilitation: A Clinician's Manual*. Philadelphia, PA: Jessica Kingsley Publishers.
- Bisaz R, Travaglia A and Alberini CM (2014) The neurobiological bases of memory formation: From physiological conditions to psychopathology. *Psychopathology* 47 (6): 347–356.
- Blood AJ and Zatorre RJ (2001) Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. *Proceedings of the National Academy of Sciences of the United States of America* 98(20): 11818–11823.
- Bradt J (2010). The effects of music entrainment on postoperative pain perception in pediatric patients *Music and Medicine* 2(3): 150–157.
- British Association for Music Therapy (BAMT) (2024) What is music therapy. Available at: <https://www.bamt.org/music-therapy/what-is-music-therapy> (accessed March 20, 2024).
- Bruscia KE (2014). *Defining Music Therapy* (3rd Edition) Barcelona Publishers.
- Camina E and Güell F (2017). The neuroanatomical, neurophysiological and psychological basis of memory: Current models and their origins. *Frontiers in Pharmacology* 8: 438.
- Christianson SA (1992) Emotional stress and eyewitness memory: A critical review. *Psychological Bulletin* 112(2): 284–309.
- Coomans MB, van der Linden SD, Gehring K, et al. (2019). Treatment of cognitive deficits in brain tumour patients: Current status and future directions. *Current Opinion in Oncology* 31(6): 540–547.
- Cuddy LL, Sikka R and Vanstone A (2015) Preservation of musical memory and engagement in healthy aging and Alzheimer's disease. *Annals of the NY Academy of Sciences* 1337: 223–231. doi: 10.1111/nyas.12617.
- Damasio A (2011) *Self Comes to Mind: Constructing the Conscious Brain*. New York: Random House.
- das Nair R, Lincoln NB, Ftizsimmons D, et al. (2015) Rehabilitation of memory following brain injury (ReMemBrIn): Study protocol for a randomised controlled trial. *Trials* 16: 6.
- Diamond A (2013) Executive functions. *Annu Rev Psychology* 64: 135–168.
- Duszkiewicz AJ, McNamara CG, Takeuchi T, et al. (2019). Novelty and dopaminergic modulation of memory persistence: A tale of two systems. *Trends in Neurosciences* 42(2): 102–114.
- Fish J, Manly T, Emslie H, et al. (2008). Compensatory strategies for acquired disorders of memory and planning: Differential effects of a paging system for patients with brain injury of traumatic versus cerebrovascular aetiology. *Journal of Neurology, Neurosurgery, and Psychiatry* 79(8): 930–935.
- Gracey F, Palmer S, Rous B, et al. (2008) 'Feeling part of things': Personal construction of self after brain injury. *Neuropsychological Rehabilitation* 18(5–6): 627–650.
- Grilli MD and Glisky EL (2010) Self-Imagination enhances recognition memory in memory impaired individuals with neurologic damage. *Neuropsychology* 24(6): 698–710.
- Hauck M, Metzner S, Rohlffs F, et al. (2013) The influence of music and music therapy on pain-induced neuronal oscillations measured by magnetencephalography. *Pain* 154(4): 539–547. doi:10.1016/j.pain.2012.12.016.
- Ho YC, Cheung MC and Chan AS (2003) Music training improves verbal but not visual memory: Cross-sectional and longitudinal explorations in children. *Neuropsychology* 17(3): 439–450.
- James W (1890) *Principles of Psychology*. New York: Holt.
- Kandel ER (2007) *In Search of Memory: The Emergence of a New Science of Mind*. New York: W.W. Norton.
- Locke J (1690) *An essay concerning human understanding*. London, New York: Penguin Classics.

- Magee WL, Clark I, Tamplin J, et al. (2017) Music interventions for acquired brain injury. *Cochrane Database of Systematic Reviews* 1: CD006787.
- Martin RC (1993) Short-term memory and sentence processing: Evidence from neuropsychology. *Memory & Cognition* 21(2): 176–183.
- McGaugh JL (2013) Making lasting memories: Remembering the significant. *Proceedings of the National Academy of Sciences of the United States of America* 110(Suppl. 2): 10402–10407.
- Miller GA (1956) The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information. *Psychological Review* 63: 81–97.
- Moss S (2016) Adaptive memory. Available at: <https://www.sicotests.com/newpsyarticle/Adaptive-memory> (accessed March 20, 2024).
- Myhrer T (2003) Neurotransmitter systems involved in learning and memory in the rat: A meta-analysis based on studies of four behavioral tasks. *Brain Research Reviews* 41(2–3): 268–287.
- Pinker S (2003) *The Blank Slate: The Modern Denial of Human Nature*. New York: Penguin Books.
- Renwick J and Woolhouse MH (2023) Reminiscence bump invariance with respect to genre, age, and country. *Psychology of Music* 51(4): 1349–1365.
- Revlin R (2012) *Cognition: Theory and Practice* by Revlin, R. Worth Publishers.
- Rousell MA (2007) *Sudden Influence: How Spontaneous Events Shape Our Lives*. Westport, CT: Praeger.
- Ruini C and Mortara CC (2021) Writing technique across psychotherapies – From traditional expressive writing to new positive psychology interventions: A narrative review. *Journal of Contemporary Psychotherapy* 52(1): 23–34.
- Särkämö T, Tervaniemi M and Huotilainen M (2013) Music perception and cognition: Development, neural basis, and rehabilitative use of music. *Wiley Interdisciplinary Reviews: Cognitive Science* 4(4): 441–451.
- Särkämö T, Tervaniemi M, Laitinen S, et al. (2008) Music listening enhances cognitive recovery and mood after middle cerebral artery stroke. *Brain* 131(Pt. 3): 866–876.
- Tajfel H, Turner JC, Austin WG, et al. (1979) An integrative theory of intergroup conflict. *Organizational Identity: A Reader* 56: 65.
- Taylor D (2010) *Biomedical Foundations of Music Therapy*. Brandon, SD: Barton Publication.
- Thaut MH and Hoemberg V (eds) (2014) *Handbook of Neurologic Music Therapy*. Oxford: Oxford University Press.
- Tulving E and Markowitsch HJ (1998) Episodic and declarative memory: Role of the hippocampus. *Hippocampus* 8(3): 198–204.
- Yngve V (1970) On getting a word in edgewise. In: *Papers from the Sixth Regional Meeting [of the] Chicago Linguistic Society*, 16–18 April, pp. 567–577. University of Chicago.

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