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COMPREHENSIVE REVIEW

Towards a neurocognitive approach to dance movement therapy for mental health: A systematic review

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Dance movement therapy (DMT) has become an increasingly recognized and used treatment, though primarily used to target psychological and physical well-being in individuals with physical, medical or neurological illnesses. To contribute to the relative lack of literature within the field of DMT for clinical mental health disorders, using a narrative synthesis, we review the scope of recent, controlled studies of DMT in samples with different psychiatric disorders including depression, schizophrenia, autism and somatoform disorder. A systematic search of electronic databases (PubMed, Science Direct, World of Science and Clinicaltrials.gov) was conducted to identify studies examining the effects of DMT in psychiatric populations. Fifteen studies were eligible for inclusion. After reviewing the principal results of the studies, we highlight strengths and weaknesses of this treatment approach and examine the potential efficacy of using bodily movements as a tool to reduce symptoms. We conclude by placing DMT within the context of contemporary cognitive neuroscience research, drawing out implications of such an orientation for future research and discussing potential mechanisms by which DMT might reduce psychiatric symptoms. DMT has clear potential as a treatment for a range of conditions and symptoms, and thus, further research on its utility is warranted.

KEYWORDS
clinical mental health, dance movement therapy, embodiment, interoception, neurocognitive, psychiatric

1 | INTRODUCTION

Dance movement therapy (DMT) has been defined by the American Dance Therapy Association (ADTA) as 'the psychotherapeutic use of movement to promote emotional, social, cognitive, and physical integration of the individual, for the purpose of improving health and well-being' ("What is dance/movement therapy?," 2014). As a relatively young treatment approach, first emerging only in the 1940s and pioneered by Marian Chace (Cruz, 2016), DMT is based on the idea that bodily and psychological changes reciprocally influence one another. In particular, DMT assumes that the physical movements of the body are shaped in part by the affective states of a person; changes in one's movement patterns have the potential to facilitate corresponding changes in their psychological and social experiences (Martinec, 2018). It is typically described as being an embodied, movement-based approach that relies on the interconnection of body and mind, movement as a language and movement as both a mode of intervention as well as an assessment tool (ADTA, 2014). This approach stands in contrast with cognitive and behavioural therapies in which talking is the dominant form of communication and expression. Cruz (2016) argues that action, observation and sensations of one's own body are at the centre of education and clinical practice of DMT. As such, DMT provides a potentially powerful but understudied route to the treatment of psychological disorders. It emphasizes the human body as its primary means of communication and expression. Although non-verbal communication is central to DMT, verbal communication plays an important role in adapting tasks and interventions to both the developmental and

verbalization skills of the population being treated. In a recent World Health Organization (WHO) scoping review of over 3,000 studies, Fancourt and Finn (2019) highlight the importance of the performing and visual arts in the prevention, management and treatment of a range of illnesses. This review aims to present an overview of the principal characteristics of DMT and proposed mechanisms followed by an integrative review and synthesis of controlled trials using DMT. Subsequently, we outline a conceptual framework for integrating DMT within contemporary cognitive neuroscience, and we conclude by outlining existing challenges and further directions for research on cognitive mechanisms and effectiveness of DMT.

Key Practitioner Message

- This review highlights the clinical efficacy of dance movement therapy (DMT) as a treatment tool across specific clinical psychological disorders.
- Cumulatively, the findings suggest that DMT has a positive impact on mental health, particularly in mood disorders.
- Existing clinical research does not control well for unspecific effects of exercise.
- Our findings provide support for the examination of DMT in relation to new cognitive neuroscience research, specifically interoception and embodied cognition, helping to explain both why and how it works in order to develop manualized, disorder and symptom-specific treatments.

1.1 | Dance movement therapy

Approaches to DMT are heterogeneous and often idiosyncratic (Brauninger, 2014). Authorities recommend that individual therapists identify their own approach to moulding a practice that matches the abilities, requirements and individual styles of clients ("What does a dance/movement therapy session look like?", 2015). Although the approaches are broad and varied, DMT, in general, relies quite heavily on the relationship between the patient and the therapist and is typically performed in groups. Types of DMT include the following: (1) *Chacian approach*: often beginning in a circle with the therapist guiding clients through a simple movement warm-up into an improvised movement experience, where specific themes stemming from the warm-up are explored, and ending in a cool down, which sometimes includes a discussion about the movement experience to connect their verbal and nonverbal experience (Solsvig, 2010); (2) *increasing awareness of the body*: becoming more aware of micromovements that occur in regular tasks, working with the idea that sensations in the body may be the initial form of our emotions; (3) *creativity and expression*: the client creates their own movement sequence generated from an inner sensation, potentially including a range of techniques and other expressive arts or verbal psychotherapy methods; and (4) *primitive expression* (PE): use of percussive rhythms, play, dance and song to work on a symbolic level with a goal of self-expression and positive orientation of drives (Margariti et al., 2012).

Another technique often used within DMT is *Authentic Movement* (Whitehouse, 1999), involving one individual as a 'mover' and another as an external 'witness', with the hypothesized mode of action being the release of unconscious feelings by the mover and becoming a witness of oneself. It is claimed that this can be achieved through attention to sensations, images and emotions, and then giving these a new form through movement, as well as through the development of a relationship between the mover and the witness. The witness encourages this inner listening and becoming of one's own witness under the assumption that 'after being seen by another, one begins to see oneself' (Musicant, 1994, p. 97). Whereas *Authentic Movement* is a practice used within DMT, *The Moving Cycle*, developed by Christine Caldwell in the 1980s, is a phenomenological body psychotherapy (BPT) method that has been informed by DMT (Caldwell & Koch, 2018). This approach relies upon a secure therapeutic bond between the patient and the therapist, with this bond encouraging well-being and healing within the patient.

DMT seems to take on, more or less, a psychodynamic approach to treatment, working from the assumption that unconscious processes can be explored through movement. With essential features of psychodynamic therapy including a focus on the therapeutic relationship, the use of interpretative and exploratory interventions and practitioner-specific techniques (Summers & Barber, 2009), the overlap between DMT and psychodynamic therapy becomes clear. Though often rooted in psychodynamic theory, DMT has a unique methodology that adopts various psychotherapeutic theories to explain its mode of action (Karkou & Sanderson, 2006). Alongside the aforementioned similarities, more specific tailored interventions may include the use of expression, metaphors, synchronization, where patients or a patient and therapist perform the same movements at the same time, and mirroring, where one imitates and copies movements performed by the therapist or another patient (Brauninger, 2014).

Further, within the area of embodied and body-based therapies and also influenced and informed by DMT is BPT. Taking a psychodynamic approach, BPT combines 'specific body-oriented, non-verbal interventions with insight-oriented, verbal techniques to obtain behavior modification' (Martin, Koch, Hirjak, & Fuchs, 2016, p. 2). BPT aligns itself with DMT in that the body is placed centrally within the mode of treatment, where it becomes the system for communication and expression (Rohricht & Priebe, 2006). Techniques involving touch, breathwork and grounding can be used in combination with traditional DMT techniques in the sessions (European Association for Body Psychotherapy, n.d.). Given the overlap between BPT and DMT, BPT is considered in this review.

1.2 | The evidence base for DMT

Dance uniquely combines social, cognitive and fitness components. As such, it is a potentially valuable intervention to prevent or treat physical

and cognitive decline (Verghese et al., 2003). Many studies on the effectiveness of DMT have been conducted with individuals with diverse physical illnesses and medical and neurological conditions. These studies typically assess measures of well-being and mood change, depression scores or other psychological outcomes pre- and post-intervention. Specifically, DMT has been used to improve well-being in patients diagnosed with breast cancer (Goldov, 2011; Sandel et al., 2005), dementia (Ho et al., 2018; Hokkanen et al., 2008), fibromyalgia (Bojner Horwitz, Kowalski, & Anderberg, 2010; Bojner Horwitz, Kowalski, Theorell, & Anderberg, 2006), brain trauma (Berrol, 2009), hypertension (Aweto, Owoeye, Akinbo, & Onabajo, 2012), Parkinson's disease (Abraham, Hart, Andrade, & Hackney, 2018; Earhart, 2009; Hackney, Kantorovich, Levin, & Earhart, 2007; Kiepe, Stöckigt, & Keil, 2012), cystic fibrosis (Goodill, 2005) and Alzheimer's disease (Dayanim, 2009). DMT has been shown to improve a range of mental health and well-being measures including mood, vitality, self-efficacy/coping, body image and anxiety (Goodill, 2006 in Koch, Morlinghaus, & Fuchs, 2007). This cumulative set of studies provides support for the use of DMT for health-related psychological outcomes and well-being of patients in the context of physical treatment or recovery from physical illness, medical conditions or neurological conditions such as cancer (Bradt, Shim, & Goodill, 2015), health-related psychological outcomes (Koch, Kunz, Lykou, & Cruz, 2014; Koch, Riege, Tisborn, & Biondo, 2019), blood pressure and exercise capacity (Conceição, Neto, do Amaral, Martins-Filho, & Oliveira Carvalho, 2016), chronic heart failure (Gomes Neto, Menezes, & Oliveira Carvalho, 2014), Parkinson's (Sharp & Hewitt, 2014), dementia (Karkou & Meekums, 2017), falls prevention (Veronese, Maggi, Schofield, & Stubbs, 2017) and physical health outcomes (Fong Yan et al., 2018).

By contrast, the literature and research exploring DMT for the treatment of clinically diagnosed mental health disorders remain sparse in comparison. Although systematic reviews and meta-analyses specifically examining DMT for clinical mental health diagnoses have been reported for depression (Mala, Karkou, & Meekums, 2012; Meekums, Karkou, & Nelson, 2015; Karkou, Aithal, Zubala, & Meekums, 2019) and schizophrenia (Ren & Xia, 2013), these reviews have been restricted to specific disorders. In a meta-analysis of the effectiveness of DMT for depression, Karkou et al. (2019) concluded that, based on the moderate- to high-quality studies included, DMT can be an effective tool in the treatment of depression. To our knowledge, one review on DMT for schizophrenia has been conducted (Ren & Xia, 2013), and the inclusion of a single randomized controlled trial (RCT) limited generalization regarding the efficacy of DMT in schizophrenia.

Given the above, there remain many open questions regarding DMT. Importantly, the concepts and mechanisms by which DMT works often remain underspecified. With a view towards integrating DMT and contemporary cognitive neuroscience research, we first review the scope and effectiveness of recent research on DMT as an intervention for psychiatric disorders. Following this, we present and discuss potential neurocognitive mechanisms of DMT and identify some of the challenges that research on mechanisms and effectiveness of DMT currently faces.

2 | METHODS

2.1 | Search strategy

A broad literature search was undertaken, following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009), examining research on group DMT or BPT in clinical mental health populations within the last 15 years. Searches were conducted using pre-decided search terms using PubMed, Science Direct, World of Science and Clinicaltrials.gov published between 2004 and August 2019. Search term combinations were as follows: ('dance movement therapy' OR 'body psychotherapy') AND ('clinical trial' OR 'mental health' OR 'RCT' OR 'psychiatric') AND/OR ('depression' OR 'dissociation' OR 'depersonalization' OR 'schizophrenia' OR 'autism' OR 'trauma' OR 'eating disorder' OR 'OCD' OR 'anxiety'). After the removal of duplicates (2,437), paper titles and abstracts were screened by the first author (LSMM). Full text of the remaining papers was then reviewed to determine eligibility by LSMM. A flow diagram of the study screening process is presented in Figure 1.

2.2 | Inclusion and exclusion criteria

Studies included in this review were required to meet the following inclusion criteria: (1) RCT or controlled trial, (2) conducted and published after 2004, (3) group intervention, (4) involving a clinically diagnosed mental health population and (5) reported outcomes specific to the effectiveness of DMT or BPT. Exclusion criteria included (1) studies including individuals with physical illnesses, medical or neurological conditions, (2) case studies, (3) uncontrolled trials, (4) non-English studies, (5) movement or exercise interventions not identified as DMT or BPT and 6) reviews or meta-analyses.

2.3 | Data extraction

Data extraction was undertaken by LSMM for all eligible studies. Extracted data included author/s, year, nationality of sample, clinical population, number of participants (total and in subgroups), assignment to condition (randomized vs. self-selection), intervention, time frame of intervention, outcome measures and principal results.

2.4 | Assessment of heterogeneity

Given the heterogeneity of included studies with regard to clinical conditions, age, outcome measures and interventions, a meta-analysis was not deemed appropriate. Instead, a narrative synthesis was conducted to describe, evaluate and summarize the findings and outcomes of the included studies.

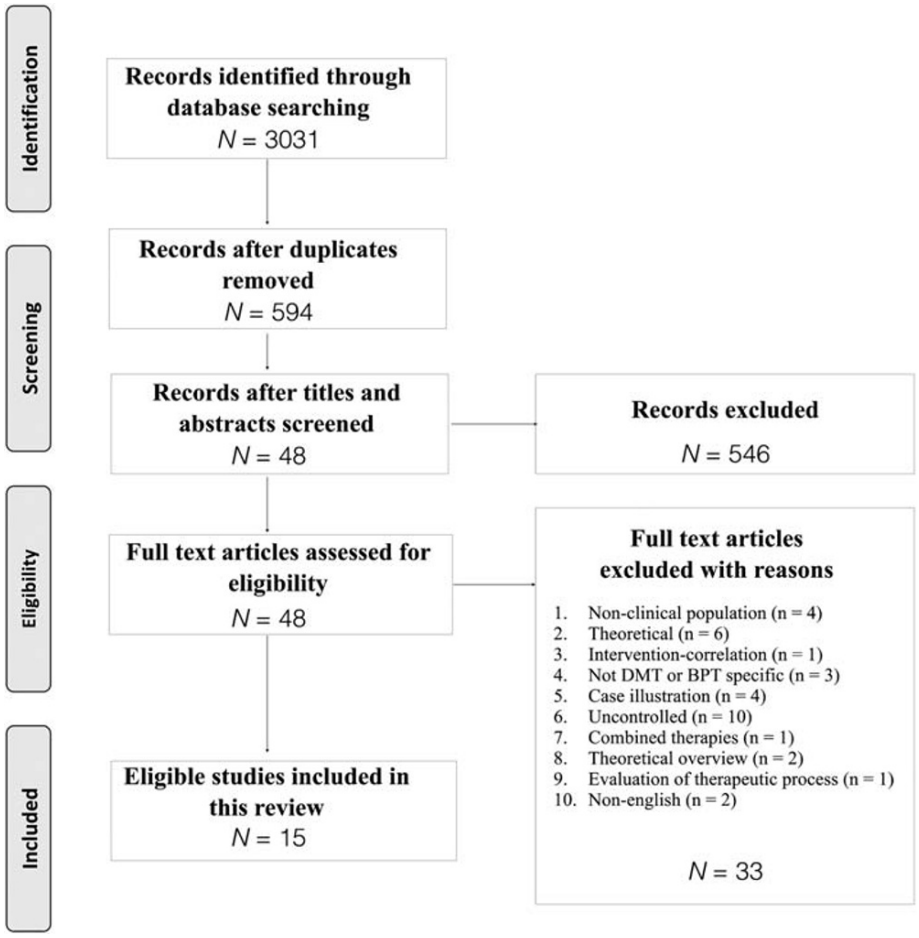

FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram

2.5 | Effect sizes

When unreported, effect sizes were calculated. Cohen's *d* (Cohen, 1992) was calculated in cases where sample sizes were equal pre- and post-treatment and Hedges's *g* (Hedges & Olkin, 1985) was calculated in cases where sample sizes differed pre- and post-treatment. Cohen's *d* was calculated by subtracting the post-treatment mean from the pre-treatment mean and then dividing this by the pooled standard deviation (*SD*). Hedges's *g* was calculated by subtracting the post-treatment mean from the pre-treatment mean and then dividing this by the pooled and weighted *SD*.

3 | RESULTS

3.1 | Study characteristics

Our review identified 15 studies that used group DMT and/or BPT interventions to treat a variety of symptoms in different psychiatric conditions including depression (k = 5), schizophrenia (k = 5), autism (k = 4) and somatoform disorder (k = 1). Detailed study characteristics are presented in Table 1. All studies reported outcomes specific to the effectiveness of DMT and/or BPT. The majority of studies came from peer-reviewed journals (k = 14) with one study from a doctoral dissertation. Outcome measures varied and were symptom specific to the clinical population being studied. Sample sizes varied from 24 (Röhricht, Sattel, Kuhn, & Lahmann, 2019) to 275 (Priebe et al., 2016) with a median size of 38. All studies included both males and females with age ranges varying from 16 to 66 and an average age of 36.7. Twelve of the 15 included studies were RCTs, and the remaining three were controlled trials.

3.2 | Depression

The most well-researched area within mental health and DMT is depression (see Karkou et al., 2019 for a recent review with meta-analyses). Jeong et al. (2005) conducted an RCT examining the effects of DMT on depression symptoms in teenagers with mild depression. All subscale scores significantly decreased following the 12-week intervention, as can be seen in the global scores of the Symptoms Checklist-9-Revision (SCL-90-R) (Global Severity Index: within-group d = 0.33; Positive Symptoms Total: within-group d = 0.32; Positive Symptoms Distress Index: within-group d = 0.54). In addition, plasma serotonin and dopamine concentrations increased and decreased, respectively, in the DMT group while very slightly decreasing and increasing, respectively, in the control group. Group × time interactions were present in both cases (serotonin:

TABLE 1 Summary of study characteristics

Author	Year	Nationality of Sample	Diagnosis	*N*	Age (*M*)	Assignment to condition
Jeong et al.	2005	South Korean	Depression	40	16	Randomized
Rohricht and Priebe	2006	British	Schizophrenia	45 BPT = 24 Control = 21	BPT = 38.3 SC = 37.7	Randomized
Koch, Morlinghaus and Fuchs	2007	German	Depression	31	42.7 Range = 21–66	Randomized
Rohricht, Papadopoulos and Priebe	2013	British	Depression	31 (21 received allocated intervention; 10 did not attend)	46.9	Randomized
Pylvanainen, Muotka and Lappalainen	2015	Finnish	Depression	33 DMT = 21 TAU = 12	41 Range = 20–29	Self-selection
Lee, Jang, Lee and Hwang	2015	South Korean	Schizophrenia	38 DMT = 18 control = 20	DMT = 41.5 Control = 41.8	Randomized
Koch et al.	2015	German	Autism	31 DMT = 16 Control = 15	22.0 Range = 16–47	Random assignment not possible due to logistics
Koehne, Behrends, Fairhurst, Dziobek	2015	German	Autism	55 SI-DMI = 27 CMI = 24	SI-DMI = 33.5 CMI group = 32.0	Self-selection based on time preferences
Martin, Koch, Hirjak and Fuchs	2016	German	Schizophrenia	68 DMT = 44 TAU = 24	DMT = 41.05 TAU = 37.52	Randomized
Hildebrandt, Koch and Fuchs	2016	German	Autism	78	22.5 Range = 14–53	Randomized
Priebe et al.	2016	British	Schizophrenia	275 BPT = 140 Pilates = 135	42.2	Randomized
Bryl	2018	American	Schizophrenia	31 (28 for analyses)	DMT = 44.67 TAU = 48.38	Randomized
Mastrominico	2018	German	Autism	57 DMT = 35 Control = 22	22.5 Range = 14–52	Randomized
Winter et al.	2018	British	Depression	23 BPT = 11 Control = 12	BPT = 48.36 Control = 48.08	Randomized
Rohricht, Sattel, Kuhn and Lahmann	2019	German	Somatoform disorder	24 Manualized BPT or TAU = 16 BPT = 8	BPT = 51.6 TAU = 47.1 waiting group)	Randomized

Abbreviations: ASIM, Assessment of Spontaneous Interaction in Movement (Behrends & Dziobek, 2009); BDI-II, Beck Depression Inventory (Beck, Steer, Ball, & Ranieri, 1996; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961); BNSS, Brief Negative Symptom Scale (Kirkpatrick et al., 2011); BSE = Body Self-Efficacy Scale (Fuchs & Koch, 2014); CEEQ, Cognitive and Emotional Empathy Questionnaire (Savage, Teague, Koehne, Borod, & Dziobek, n.d.); CORE-OM, Clinical Outcomes in Routine Evaluation - Outcome Measure (Evans et al., 2002); DBIQ = Dresden Body Image Questionnaire (Pöhlmann, Roth, Brähler, & Joraschky, 2014); EIS, Embodied Intersubjectivity Scale (Koch); FBT, Questionnaire of Movement Therapy (Gunther & Koch, 2010); HADS, Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983); HAM-D, Hamilton Depression Rating Scale (Hamilton, 1960); HBS, Heidelberger Befindlichkeitsskala (Koch et al., 2007); HSI, Heidelberger State Inventory (Koch et al., 2007); IRI, Interpersonal Reactivity Index (Davis, 1983); MANSA, Manchester Short Assessment of Quality of Life (Priebe, Huxley, Knight, & Evans, 1999); MET, Multifaceted Empathy Test (Dziobek et al., 2008); PANSS = Positive and Negative Symptom Scale (Kay, Fiszbein, & Olper, 1987); PHQ-9 = Primary Health Questionnaire (Kroenke, Spitzer, & Williams, 2001); SANS, Scale for the Assessment of Negative Symptoms (Andreasen, 1984); SAS, Simpson-Angus Scale (Simpson & Angus, 1970); SCL-90-R, Symptoms Checklist-9-Revision (Derogatis, 1994); SES, Rosenberg Self- Esteem Scale (Rosenberg, 1965); SF-36, Short-Form Health Survey-36 (Ware & Sherbourne, 1992); SOMS-7, Somatic Symptom Screening Scale (Rief & Hiller, 2003); STAI, State–Trait Anxiety Inventory (Speilberger, Gorsuch, & Lushene, 1970); STAXI, State-Trait Anger Expression Inventory (Speilberger, 1988); WHO-DAS 2.0 = World Health Organization Disability Assessment Schedule 2.0 (Üstün, Kostanjsek, Chatterji, & Rehm, 2010).

TABLE 1 Continued

Author	Intervention/manualization	Individual vs. group	Control group	Length and drequency of treament	Outcome measures
Jeong et al.	DMT	Group	Waiting list	3 × 45-min sessions across 12 weeks, 3 sessions/week	SCL-90-R Plasma serotonin and dopamine concentrations
Rohricht and Priebe	DMT + TAU	Group – max 8 patients	Supportive counselling (SC) + treatment as usual (TAU)	20 × 60- to 90-min sessions across 10 weeks, 2 sessions/week	PANSS, MANSA
Koch, Morlinghaus and Fuchs	DMT	Group	Music-only condition OR Movement-only condition (home trainer bike)	One group session, 20–30 min	HBS, Gait velocity, therapy ranking
Rohricht, Papadopoulos and Priebe	Body Psychotherapy (BPT)	Group – max 8 patients	Waiting list receiving TAU	20 × 90-min sessions across 10 weeks + treatment as usual	Primary outcome: HAM-D Secondary outcomes: SES, MANSA
Pylvanainen, Muotka and Lappalainen	DMT + TAU	Group – max 4–7 patients	TAU	12 × 90-min sessions across 12 weeks + TAU	BDI-II, HADS, SCL-90, CORE- OM
Lee, Jang, Lee and Hwang	DMT + medical treatment	Group	Medical treatment only	12 × 60-min sessions across 12 weeks	STAXI, BDI, STAI, PANSS
Koch et al.	DMT	Group – max 4–10 patients	No intervention	7 × 60-min sessions across 7 weeks	HIS, FBT, EES, Evaluation of mirror qualities of the movement
Koehne, Behrends, Fairhurst, Dziobek	Imitation and synchronization-based dance movement intervention (SI-DMI)	Group – max 4–10 patients	Control movement intervention (CMI) focusing on motor coordination	SI-DMI: 10 × 90-min sessions across 3 months	MET, IRI, ASIM
Martin, Koch, Hirjak and Fuchs	DMT/BPT	Group – max 8 patients	Waiting list + treatment as usual (TAU)	20 sessions BPT/DMT across 10 weeks, 2 sessions/week	SANS, SAS
Hildebrandt, Koch and Fuchs	DMT	Group - max 10 patients	Waiting list	10 × 60-min sessions across 10 weeks	SANS
Priebe et al.	Manualized BPT	Group	Pilates class	20 × 90-min sessions across 10 weeks, 2 sessions/week	PANSS, SAS Secondary outcomes: measures of psychopathology, functional, social, service use and treatment satisfaction outcomes
Bryl	DMT	Group	Standard care	20 × 60-min sessions across 10 weeks, 2 sessions/week	PANSS, BNSS, WHO-DAS 2.0, SDS, Semi-structured exit interviews
Mastrominico	DMT	Group – max 5–10 patients	Waiting list	10 × 60-min sessions across 10 weeks	CEEQ, IRI subscale (Empathic Concern), GO, BSE, EIS
Winter et al.	BPT + TAU	Group	Waiting list (BPT after 12 weeks)	20 × 90-min sessions across 10 weeks	Repertory grid technique (Fransella, 2004), MANSA, HAMD-21, Clinical global impression severity of illness (Guy, 1976), RSE, VAS on body cathexis
Rohricht, Sattel, Kuhn and Lahmann	Manualized BPT for somatoform disorder (SD)	Group – max 10 patients	Treatment as usual (TAU)	20 × 90-min sessions across a 4- to 6-month period (one session per week)	PHQ-9, SOMS-7, SF-36, DBIQ, The Helping Alliance Scale

d = 1.02; dopamine: d = 1.69). Cortisol concentrations did not change significantly in either group. Jeong et al. (2005) speculated that the DMT-mediated modulation of dopamine and serotonin concentrations might underlie the DMT-mediated reductions in depression, but they did not report correlations between these changes.

In an investigation of the effects of a dance intervention in patients with depression (Koch et al., 2007), participants were randomly assigned to one of three groups: the dance group performing a traditional upbeat circle dance from Israel; the music group listening to the music of the dance; and the movement-only group who moved up to the same level of arousal as the dance group on a home trainer bike (ergometer). In this particular study, and in contrast to the other studies reviewed, the authors measured the short-term effects of the intervention immediately after a single session only. Results indicated that those assigned to the DMT group exhibited significantly lower post-treatment depression scores compared with the music-only (d = 1.28) and movement-only (d = 0.90) control groups. Those in the DMT condition also showed a significant increase in vitality as compared with the music-only group (d = 0.86). Therefore, this dance intervention seemed to act specifically and immediately on the short-term reduction of depression.

In the first RCT to do so, Röhricht, Papadopoulos, and Priebe (2013) evaluated the effectiveness of BPT in patients with chronic depression. Participants were randomly allocated either to immediate manualized BPT + treatment as usual or to a waiting group that received treatment as usual followed by BPT 12 weeks later. Post-treatment depression scores indicated that patients in the immediate BPT group had significantly lower symptom scores as compared with wait-list controls (g = 0.95). No significant differences were observed for self-esteem and quality of life.

Working with a subset of patients from the RCT conducted by Röhricht et al. (2013), Winter et al. (2018) investigated how BPT may alter one's views of themselves and their body in individuals with chronic depression. Within-group analyses of the immediate BPT + treatment as usual group indicate significant improvements in symptoms of depression (d = 1.10), self-esteem (d = 0.64) and a reduction in constriction in construing the bodily self (d = 1.06). This reduction in constriction suggests that body-focused therapy may allow one to become more aware of bodily states. A regression analysis showed that patients randomly allocated to the immediate BPT + treatment as usual group exhibited larger reductions of depression symptoms (β = −0.45; R^2 = 0.21) than those in the waiting list group. In contrast, while on the waiting list, patients in the waiting list group exhibited a greater reduction in perceived social isolation (β = 0.61; R^2 = 0.40) than those in the immediate BPT + treatment as usual group. Many non-significant findings within this study do not allow for firm conclusions to be drawn in relation to BPT and its impact on self-constriction, but the findings are still consistent with those as seen above wherein BPT acts to reduce symptoms of depression.

Pylvänäinen, Muotka, and Lappalainen (2015) were interested in whether the addition of group DMT to treatment as usual had benefits in alleviating symptoms of depression in adult outpatients relative to treatment as usual alone. The DMT intervention consisted of both the *Chacian method* and *Authentic Movement*. The addition of DMT was beneficial in the treatment of depressed patients, with symptom scores decreasing significantly more in the DMT + treatment as usual group as compared with the treatment as usual group across the study period (between-group differences ranging from ds = 0.60–0.85). There were also positive, albeit non-significant, changes in the DMT group on scores of global distress. The effects of the addition of DMT were present whether or not the patient was taking antidepressants. Depression scores at the 3-month follow-up indicate medium to large effect sizes ranging from ds = 0.62–0.82 in the DMT group as compared with small effect sizes ranging from ds = 0.15–0.37 in the treatment as usual group.

Cumulatively, these studies suggest that DMT and BPT interventions were associated with reduced depressive symptoms with moderate effects. Although the results are more varied and tended to be non-signficant for measures including self-esteem, quality of life or global distress, DMT and BPT may be important interventions to include in the treatment of mood disorders like depression. A further exploration of the effects of DMT and BPT on neurotransmitters (as seen in Jeong et al., 2005) as well as other physiological changes associated with the treatment is required.

3.3 | Schizophrenia

Rohricht and Priebe (2006) conducted the first RCT specifically designed to test the effectiveness of manualized BPT on negative symptoms in chronic schizophrenia. They developed a BPT treatment manual to reach a clinical and disorder-specific method targeting negative symptoms in schizophrenia. DMT might be particularly useful to ameliorate affective or motor symptoms, including affective blunting and motor retardation in this patient group. Patients in the BPT group not only attended more sessions but also had significantly lower post-treatment negative symptom scores (within-group d = 1.07), blunted affect scores (within-group d = 1.37) and motor retardation scores (within-group d = 0.72). This remained the case at a 4-month follow-up. It was found that BPT was associated with increased effectiveness in the improvement of medication-resistant and enduring negative symptoms than *supportive counselling* (SC). Other subscale scores including positive symptoms, general symptoms and total sum as well as the quality of life measure did not show statistically significant differences both between and within the DMT and SC groups. This was an exploratory trial with a small sample size and a high attrition rate in the control group.

In a large, multicenter RCT, Priebe et al. (2016) further explored the use of group BPT in the treatment of negative symptoms of schizophrenia. The treatment and control groups were matched regarding the number of sessions given and approximate level of physical activity (BPT vs. Pilates class). In contrast with the encouraging results above, no significant between-group differences in the primary outcome measure (negative symptoms subscale of the Positive and Negative Symptom Scale [PANSS]) were observed (adjusted difference in means = 0.03 [95% confidence interval (CI), −1.11 to 1.17]). This was

the case both immediately after treatment and at the 6-month follow-up. However, the secondary outcomes did show small, positive differences for the BPT group in the CAINS expression subscale at the end of treatment (d = 0.28), and in extrapyramidal symptoms (i.e., muscle spasms, rigidity, restlessness and jerky movements) including both at the end of treatment (d = 0.26) and at the 6-month follow-up (d = 0.27).

Bryl (2018) continued to examine DMT as treatment of negative symptoms in schizophrenia. In this mixed methods intervention pilot study, the author expected that movement-based interventions would be suited to access and give a voice to the non-verbal nature of negative symptoms in schizophrenia. Group DMT was compared with standard care (SC) alone. Symptom scores indicated an improvement in both groups with the SC group exhibiting a greater reduction on the overall BNSS score (d = 0.56), and perhaps surprisingly, mean scores on the PANSS indicated a decrease in negative symptoms for those in the SC group (d = 0.32) but a very minor increase in negative symptoms in the DMT group (d = 0.15). Further, an analysis of World Health Organization Disability Assessment Schedule (WHO-DAS) scores, measuring psychosocial functioning, indicate a moderate effect present, benefitting the SC group (r = 0.4). However, and in contrast, qualitative results indicated that patients in the DMT condition reported lowered symptoms of antisocial activity, avolition and distress as well as increased improvement in mobility, self-care and cognition.

Exploring a different symptom subset, Lee, Jang, Lee, and Hwang (2015) assessed the effects of DMT on psychotic symptoms and affect in patients with schizophrenia. After a 12-week intervention, patients in the DMT group showed large post-treatment decreases in depression (within-group d = 1.35), PANSS negative symptoms (d = 0.88), state anger (d = 0.61) and ability to control anger (d = 0.53) as compared with a control group receiving medical treatment only. However, there were no statistically significant changes observed in trait anger, expressions of anger out, PANSS positive symptoms and, perhaps most interestingly, state and trait anxiety between or within the two groups.

In a multicenter RCT, Martin et al. (2016) aimed to treat symptoms of schizophrenia from the perspective that disembodiment represents a central feature of the disorder. Patients receiving group DMT had significantly lower scores on the *Scale for the Assessment of Negative Symptoms* (SANS, Andreasen, 1984; r = 0.39) including subscale measures of blunted affect (r = 0.31) and deficits in attention (r = 0.36), both of which can be attributed to deficits in embodied self-awareness, providing support for body-based therapies like DMT/BPT in treating negative symptoms in schizophrenia.

These results suggest that DMT and BPT may be effective in reducing both negative and psychotic symptoms in individuals with schizophrenia, as well as improve psychosocial functioning and ability to control anger, but this is not reliably found across the studies reviewed. Both Priebe et al. (2016) and Bryl (2018) did not find significant differences between the DMT and control groups on their primary outcome measures examining negative symptoms. Further RCTs specifically examining the effect of DMT on negative symptoms in schizophrenia using manualized treatment protocols are required to substantiate these preliminary results.

3.4 | Autism

In an RCT investigating the effects of a 10-week manualized DMT intervention on negative symptoms in patients with autism spectrum disorder (ASD), Hildebrandt, Koch, and Fuchs (2016) suggest that DMT has the potential to reduce overall negative symptoms. Sessions consisted of the Chace-Circle, mirroring, where participants both imitated and led each other in their movements, and verbal processing to discuss feelings and thoughts on the session. Although the results did not reach statistical significance at the conventional 0.05 level, they suggested a positive trend towards increased reduction of symptoms in the group receiving the DMT intervention relative to the control group. Mastrominico et al. (2018) conducted another RCT examining the effects of DMT on adult patients with ASD after a 10-week manualized DMT intervention but observed no significant effects. The measure of interest was empathy. The authors attributed the lack of significant results to the use of self-report measures and a large amount of missing data. They also suggested there are a variety of other symptoms to be targeted within ASD that may better respond to DMT as treatment and recommend these for future research.

In line with Mastrominico et al. (2018), Koch, Mehl, Sobanski, Sieber, and Fuchs (2015) conducted a feasibility study with an interest in the specific effects of mirroring in movement on well-being, body awareness, self-other distinction, social competence and empathy in young adults with ASD. Participants in the intervention group, which included dyadic movement exercises and verbal processing, showed significant improvements with medium to large effect sizes in body awareness (d = 0.62), self-other awareness (d = 0.72), psychological well-being (d = 0.68) and social skills (d = 0.67). Here, as in the Mastrominico et al. (2018) study, empathy did not show a statistically significant improvement relative to the control groups. Koch et al. (2015, p. 338) suggest that the mirroring-based DMT intervention seemed to address the developmental components of autism, rather than the 'presently prevailing theory-of-mind approach'.

Koehne, Behrends, Fairhurst, and Dziobek (2015) were interested in targeting the impaired social cognition that is part of ASD. The authors examined the effects of an imitation- and synchronization-based dance/movement intervention (SI-DMI), under the assumption that imitation and synchronization may be important to enhancing emotion inference and empathy. Participants in the SI-DMI treatment group displayed significant improvements in emotion inference (d = 0.58), automatic imitation (d = 0.47), asynchrony (d = –0.63), imitation/synchronization (d = 1.27) and reciprocity/dialogue (d = 1.25), as compared with the controlled movement intervention (CMI) group in emotion inference (d = –0.04), automatic imitation (d = –0.03), asynchrony (d = 0.13), imitation/synchronization (d = –0.47) and reciprocity/dialogue (d = –0.16). In line with the research above (Koch et al., 2015; Mastrominico et al., 2018), there was no significant difference in empathy, as well as in orientation of gaze and body and relation in spatial movement, between the two groups.

These studies evidenced positive trends towards symptom reduction (Hildebrandt et al., 2016) as well as improvements in areas

including body awareness, emotion inference, self-other awareness and imitation synchronization (Koch et al., 2015; Koehne et al., 2015) in individuals with ASD. By contrast, DMT and BPT were not associated with an improvement in empathy. Perhaps, as suggested by Koch et al. (2015), DMT should be targeted more specifically to the developmental components of ASD, with less of a focus on improving empathic deficits.

3.5 | Somatoform disorder

Röhricht et al. (2019) implemented a group BPT manual, including the activation of resources and strengthening of self-regulation, for BPT somatoform disorder (BPT-SD). The core concept is that the body is the central focus of the therapy in BPT for somatoform disorder. Results indicated that somatic symptom levels reduced (g = 0.51) and subjective quality of life significantly increased (g = 0.66) in the BPT-SD group compared with the treatment as usual group (somatic symptoms g = −0.23; quality of life g = −0.49). A smaller reduction was present with depression scores and the total number of symptoms, while the physical component scores within the quality of life measure did not change post-treatment. The authors suggest that an increase in self-acceptance could be a possible mechanism leading to the results observed.

Cumulatively, these findings suggest that both DMT and BPT can have a positive impact on mental health, particularly in mood disorders. An outstanding issue is whether such results would be observed with other forms of exercise and to what extent the findings may depend on the client's previous dance experience. Surprisingly, potential benefits on bodily awareness (i.e., in somatoform disorder and imitation synchronization [ASD]) have only recently come into focus, despite being central to the conceptualization of DMT.

3.6 | Limitations of DMT for mental health

DMT has been found to have a positive impact on perceptions of the self and body, well-being, body image, relationship perception, emotion and biography in psychiatric patients (Pylvänäinen et al., 2015). However, limitations within the research are present. The foregoing review points to some promising results but also a relative lack of research, in general, conducted across disorders. There was a significantly more limited scope of DMT research in the area of specific mental illnesses in comparison with well-being and mood in the context of physical illness, medical condition or neurological condition. Further research exploring DMT specifically for the treatment of psychiatric disorders is important to the development of the field.

Another limitation is small sample size. As can be seen in Table 1, sample sizes varied from 24 to 275 with a median size of 38. Increases in sample sizes will help to enhance reliability, generalizability and statistical power. Further increases in reliability, generalizability and power require the use of active control groups. In the studies reviewed, many included either waiting list or non-active controls (Hildebrandt et al., 2016; Martin et al., 2016; Rohricht, Sattel, Kuhn, & Lahmann, 2019; Rohricht & Priebe, 2006; Rohricht, Papadopoulos, & Priebe, 2013; Jeong et al., 2005; Pylvänäinen et al., 2015; Mastrominico et al., 2018; Lee et al., 2015; Bryl, 2018; Koehne et al., 2015; Winter et al., 2018). Hildebrandt et al. (2016) suggest the importance of an active control group to examine whether symptom reduction occurs due to the addition of physical activity in general or if it is due to some aspect of the DMT in particular. This suggestion is important across the DMT literature where the use of waiting list controls is common (Koch et al., 2019). Karkou et al. (2019) propose that studies should include an active control group of another, readily available and type of treatment. This would increase understanding in the area of mechanisms by which DMT may be effective. Although an active control group was included in three of the studies reviewed (Koch et al., 2007; Koehne et al., 2015; Priebe et al., 2016), their inclusion needs to become more common with further research dedicated to determining the most suitable groups for different research questions.

Following this, full-scale multicenter RCTs should become the standard within DMT for mental health research. Manualizing treatments and developing disorder and symptom-specific interventions would also increase reliability and generalizability, as discussed further below. Another interesting direction could be administering treatment on an individual basis, rather than group interventions as most commonly seen in available RCTs. This could open a whole other avenue of research in terms of group effects and the impact of social interaction. Further, the inclusion of follow-up measures Pylvänäinen et al., 2015; Rohricht & Priebe, 2006; Mastrominico et al., 2018; Röhricht et al., 2019) as common practice will also allow for a better understanding of whether or not DMT or BPT can produce positive, lasting effects on symptom reduction.

Expanding upon the need for more reliable and valid outcomes, the inclusion of physiological and/or more objective measures along with subjective self-report measures is crucial. To identify the psychological and brain mechanisms that may mediate DMT, it seems important to include behavioural, physiological and neural measures of embodiment and nonverbal communication. With the exception of the Jeong et al. (2005) study, which measured plasma serotonin and dopamine and the Koehne et al. (2015) study, which measured automatic imitation, interpersonal synchronization and an assessment of spontaneous interaction in movement, no other research explored in this review in the area of clinical mental health disorders (versus well-being in individuals with Parkinson's or dementia, e.g., Abraham et al., 2018; Ho et al., 2018) involved any psychophysiological or neural measure. There is a need for more rigorous experimental methods including mixed-methods quantitative and objective physiological and neurophysiological data collection in combination with subjective self-reports.

The current scope of research raises many outstanding questions regarding DMT. Importantly, the concepts and mechanisms by which DMT works remain rather opaque. For example, what are the specific mechanisms involved in expressing emotions through bodily movements, and how does this work to ameliorate particular symptoms? This is

where cognitive neuroscience can help both in terms of clarifying the mechanisms of how DMT works (i.e., by enhancing bodily or interoceptive awareness) as well as what dysfunctional cognitive mechanisms are being addressed through DMT (i.e., mood in affective disorders and dissociation in depersonalization–derealization disorder [DDD]). An important step forward in relation to this would be examining embodiment/disembodiment from the perspective of cognitive neuroscience.

4 | COGNITIVE AND BRAIN MECHANISMS OF DMT

It is clear from the previous sections that DMT has the potential to provide widespread and varying benefits in patients with depression, schizophrenia, autism and somatoform disorder. Although these studies offer some positive outcomes and support for the use of DMT as a treatment tool, it is unclear *how* DMT achieves these results. Research in the area of DMT appears to be lacking in integration with more contemporary, scientifically rooted ideas. Here, we will focus on two research areas looking at the role of dance expertise in embodied cognition and interoception and discuss how they might be relevant to inform the current understanding of the mechanisms and application of DMT.

4.1 | Embodied cognition

DMT practitioners and researchers often make references to embodiment, but, with the exception of a few studies (Martin et al., 2016; Hildebrandt et al., 2016; Mastrominico et al., 2018), the term remains underspecified. Goldman and de Vignemont (2009, p. 154) have explored ideas of embodied social cognition and define embodiment as the 'mental representations in bodily formats that have an important role in cognition'. Indeed, cognitive neuroscience research provides evidence that dance expertise impacts on a variety of cognitive functions including embodiment (Blasing, Calvo-Merino, Cross, Honisch, & Stevens, 2012). For example, Warburton, Wilson, Lynch, and Cuykendall (2013) showed that dancers use a technique called 'marking' to aid with long-term memory of movements. Marking consists of repeating the movements of a sequence in a reduced form, such as using the hands to do a sequence of movements that would normally be done with the feet. Following marking, dancers experience processing benefits and have a better performance than when dancing full out (Warburton et al., 2013). This is a prime example of embodied cognition: through marking movements, dancers are able to improve recollection and enhance performance.

There is also evidence that dancers are superior at recognizing subtle emotions from whole body movement. Christensen, Gomila, Gaigg, Sivarajah, and Calvo-Merino (2016) explored how dance training and expertise modulates emotional processes. Professional ballet dancers, as compared with controls, were more sensitive in recognizing different emotions in movement when shown videos of movements expressing happy or sad emotions. Thus, dance expertise seems to heighten one's sensitivity to observed affective body movements.

Proprioception, or an awareness of one's positioning of their body in space (Sherrington, 1907), has also been shown to be modulated by dance expertise (Jola, Davis, & Haggard, 2011). Relative to controls, dancers were better able to match a target location based on their proprioceptive awareness. The authors argue that dancers rely less heavily on visual information than nondancers, allowing the integration of proprioceptive information to guide the movements of their body. An increased awareness of the body can also be seen in dancer's interoceptive accuracy (Christensen, Gaigg, & Calvo-Merino, 2017). Interoceptive accuracy, or objective performance on tasks measuring bodily awareness/changes (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015), positively correlates with a range of traits including emotional sensitivity and empathy (Dunn et al., 2010; Fukushima, Terasawa, & Umeda, 2011; Herbert, Pollatos, Flor, Enck, & Schandry, 2010 in Christensen et al., 2017). Interoceptive accuracy was compared between professional ballet dancers and a matched control group of nondancers using a heartbeat detection task, with results suggesting that dancers have superior interoceptive accuracy. Further, years of dance experience also covaried with interoceptive accuracy such that more senior dancers displayed the highest scores overall, followed by junior dancers and then controls.

Finally, dance training improves performance on mental rotation tasks (Jansen, Kellner, & Rieder, 2013). In this study, one group of children received 5 weeks of creative dance training, whereas the others received physical education lessons. Mental rotation performance was evaluated pre- and post-training with results showing that children in the creative dance group displayed greater improvement in mental rotation performance than those in the physical education group.

Dance experience or expertise seems to modulate a range of cognitive-perceptual functions, and dancers can be considered to be experts in embodied cognition (Warburton et al., 2013). Though DMT interventions are unlikely to generate expertise levels comparable with professional dancers, much research has shown that dance training changes behaviour and brain function within weeks and sometimes even days of practice (Cross, Kraemer, Hamilton, Kelley, & Grafton, 2009; Kirsch & Cross, 2015). It is possible, then, that some of the benefits of DMT are mediated by the mechanisms described above and enhance bodily awareness. Continued research into and an understanding of embodiment in relation to dance and movement as well as how impaired or deficient embodiment can be targeted in disorders where this is a feature is important to future DMT research and treatment.

4.2 | Interoception

One phenomenon that has received considerable attention in recent years and that might prove useful in understanding the effects of DMT is *interoception.* Interoception refers to a sense of awareness of one's own body and its internal states (Tsakiris & De Preester, 2018)

yet surprisingly is not typically referenced in the context of DMT. This body-to-brain axis of signals originating from the internal body and visceral organs ties in heavily with ideas of and approaches to embodiment (Hindi, 2012). There is mounting evidence for the role of heart-focused interoception in decision making, emotional experience and clinical disorders (Schulz, 2016), and there is a consistent thread through neuroimaging research examining interoception and corresponding brain regions. Schulz (2016), Seth (2013) and Damasio and Carvalho (2013) review evidence that suggests that the insula functions as the comparator neural mechanism. Based on its positioning, the insula is able to process both top-down predictions and bottom-up prediction errors in relation to each other, comparing the two. It has the capability to integrate signals as well as sense and create changes in one's physiological state (Seth, 2013). Further, and one particular example, research by Sierra and David (2011), Stein and Simeon (2009), Seth (2013), and Medford (2012) has consistently found evidence for a crucial prefrontal–limbic interaction in DDD, a condition including feelings of unreality and disturbances to one's sense of self (Hunter, Salkovskis, & David, 2014). In this case, hyperactivity of the prefrontal cortex is paired with suppression of the limbic structures, including the anterior insula, which is associated with decreased awareness of the internal signals of the body. Herbert and Pollatos (2012) propose interoception as the fundamental feature of human embodiment and suggest that interoceptive states are building blocks that contribute to this fundament of the 'self,' where the self is grounded in the body. A wealth of evidence suggests that compromises to interoception are present in a range of psychiatric and psychosomatic disorders including anxiety, depression, addiction and dissociative disorders (Dieterich-Hartwell, 2017; Levine & Land, 2016; Seth, 2013; Tsakiris & De Preester, 2018). That being said, one may assume that disorders with an interoceptive component, such as OCD or dissociative disorders for example, may be very good targets for DMT as treatment.

DMT rests upon the assumption that bodily and psychological or emotional changes reciprocally influence one another (Koch & Fischman, 2011). However, central to the experience of emotion and affective states is, first, an internal awareness of the state of the body (Damasio & Carvalho, 2013). Damasio and Carvalho (2013) suggest that changes to the body will result in both automatic physiological responses and feelings, also described as 'mental experiences of body states' (p. 143). Any deviations from homeostasis are detected by the interoceptive system within the body, with descriptions of feelings then being in reference to one's internal state. A core feature of DMT is attending to and being aware of one's own body and its physiological and psychological feelings and boundaries. Grounding research on DMT within contemporary research on interoception and bodily awareness has the potential to significantly advance understanding of this mode of therapy, improve disorder- or symptom-specific tailoring of treatment and further empirically driven optimization of DMT protocols. Towards this end, Dieterich-Hartwell (2017) presented a DMT application model based on the assumption that an improvement in interoception is central to psychological well-being. Specifically, in the area of dissociation and trauma, Dieterich-Hartwell advocates for the importance of a bottom-up approach where the individual is reached/treated through their somatic symptoms, with patients being encouraged to pay attention to their bodies and sensations (see also Pierce, 2014; Jorba-Galdos, 2014). An attention to the body through interoception by tracking and identifying physical sensations, focusing on specific body parts, breath and muscle tension may allow for an increased awareness of the body. An exploration of interoceptive deficits across mental health disorders as well as measurements of interoception taken pre- and post-treatment with DMT would help to shed light on this idea and give DMT a greater neurocognitive grounding. Corroborating this, Pylvänäinen and Lappalainen (2018) highlight the need for further studies investigating the core processes in DMT that are responsible for changes in mood and psychological well-being.

Grounding DMT in cognitive neuroscience does not just provide a theoretical framework but also new and innovative measures of its effectiveness. The incorporation of implicit neural, physiological and behavioural measures such as mobile electroencephalography (EEG), interoceptive awareness and accuracy (Schandry, 1981), proprioceptive accuracy (Jola et al., 2011) and time perception (Wearden, 1991; Orgs, Bestmann, Schuur, & Haggard, 2011; Orgs, Kirsch, & Haggard, 2013) could provide more control to current DMT research and allow for a better understanding of how DMT may work to target specific symptom reduction. The tasks and measures developed in these fields are potentially less biased and more robust than self-report measures of symptom severity. Beyond this, the combination of DMT with cognitive neuroscience could also help to increase the chance of obtaining research funding by way of allowing experimentally testable predictions as to how DMT works. Such funding would help to remove some of the current obstacles in place that prevent DMT from being recognized as an independent form of treatment for psychiatric disorders, by making full-scale multicenter RCTs possible.

5 | MANUALIZATION OF TREATMENT

As previously suggested (Karkou et al., 2019; Koch et al., 2014; Meekums, Karkou, & Nelson 2015) and expanded upon in this review, there is a compelling need to focus future research on manualizing treatments with much more detail, developing new disorder- or symptom-specific DMT-based treatments and better understanding the key elements and mechanisms of DMT underlying its clinical efficacy. The particular dysfunctional cognitive mechanisms for individual disorders or categories of symptoms could be addressed with controlled interventions tailored to those mechanisms. According to Koch, Riege, Tisborn, and Biondo (2019, p. 29), 'one important issue in most intervention studies is the question about unspecific and specific effects of the intervention'. Getting a grip on these central, active and precise elements by which DMT can be effective would therefore strengthen outcome research (Hayes, 2013 in Koch et al., 2019). Manualization of DMT protocols will facilitate replication and generalization and are likely to improve validity. Although there

are certain subtypes of DMT, such as PE or the *Chacian approach*, there have yet to be well-used, standardized interventions tailored to specific psychological or physical disorders and symptoms. Within this review, six of the 15 studies aimed to manualize BPT catered to the disorders being researched (negative symptoms in schizophrenia, Rohricht & Priebe, 2006; depression, Röhricht et al., 2013; depression, Winter et al., 2018; schizophrenia, Martin et al., 2016; negative symptoms in schizophrenia, Priebe et al., 2016; and somatoform disorder Röhricht et al., 2019). Although such efforts represent a promising step forward, the continued development of even more disorder- or symptom-specific movement-based interventions that aim to target central and particular aspects of individual disorders is an important and necessary way forward. One starting point might be to conduct studies comparing widely used DMT interventions such as the *Chacian approach*, PE and *Authentic Movement* on a specific clinical patient population to examine if one had a particularly beneficial effect over the others. This could be a first step forward in gaining a better understanding of the mechanisms by which DMT can work.

6 | CONCLUSIONS

In recent decades, DMT and BPT have been applied as an intervention in the treatment of a range of psychiatric symptoms. A systematic review of this literature yields some evidence for the clinical efficacy of these interventions, but further research is required to substantiate the evidence. Preliminary evidence suggests that the mechanisms underlying DMT and BPT include improvements of embodied cognition and interoception. DMT has the possibility of moving to the core of neurorehabilitation, trauma treatment and treatment in other areas due to how it merges the mind and body (Cruz, 2016). To reach this possibility and to use DMT in a more targeted, evidence-based way to treat psychiatric conditions, it will be necessary to integrate traditional methods of DMT with contemporary cognitive neuroscience research on embodiment and interoception.

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CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

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