Bodily awareness in depersonalization-derealization disorder

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Contents

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Abstract

Depersonalization-derealization disorder (DDD), a dissociative disorder encompassing disconnections from the self and from reality, remains a widely unknown and underdiagnosed condition. The broad aim of this thesis is to generate a better understanding of DDD from a body-based perspective and to present DDD as a suitable candidate for Dance Movement Therapy (DMT). In the current literature, there is a clear lack of work exploring the potential benefits of body-based therapies for DDD. I first explore DMT and the often-neglected neurocognitive concepts that may be involved including embodied cognition and interoception, with Chapter 2 presenting an in-depth review of controlled trials of DMT for clinical mental health conditions.

Chapters 3 and 4 are focused on better characterizing and understanding DDD. Chapter 3 presents a latent profile analysis of psychometric measures of depersonalization-derealization, anxiety, and dissociation to determine whether symptom heterogeneity in DDD is attributable to the presence of latent subgroups. Chapter 4 presents a study examining the role of verbal suggestibility in DDD and its relationship to depersonalization-derealization symptoms, mindfulness, anxiety, and visual imagery. Both of these chapters have implications for the aetiology, mechanisms, treatment, and classification of DDD.

Chapters 5 and 6 explore DMT for DDD, with Chapter 5 presenting an online intervention study and Chapter 6 presenting an in-person intervention study. Two controlled dance tasks to differentially engage with the body as a means of symptom reduction in DDD were developed: one promoting explicit body awareness and the other implicitly boosting the salience of bodily signals. Dance is presented as a bespoke and efficacious tool to reduce symptoms in DDD whilst improving a sense of body awareness. This research highlights the need for a better understanding of bodily processes in DDD and provides compelling evidence for the continued development of body-based interventions targeting both interoception and mindfulness in this population and in dissociation, more broadly.

Contributions

Subsections of Chapter 1 are adapted from the introductions of the manuscripts described below, published throughout my PhD. Accordingly, the introductions for the manuscripts presented in Chapters 2 – 5 have been modified from the original publications.

In Chapter 2, I conducted the systematic review and led the writing of the manuscript. Guido Orgs supervised this review and assisted with manuscript editing. Devin Terhune and Elaine Hunter also assisted with manuscript editing. This manuscript has been published in *Clinical Psychology & Psychotherapy* (Millman, Terhune, Hunter, & Orgs, 2020).

In Chapter 3, I conducted the statistical analyses and led the writing of the manuscript. The design was co-created with Devin Terhune who supervised the analyses and assisted with manuscript writing and editing. Elaine Hunter, Anthony David, and Guido Orgs also assisted with manuscript editing. This manuscript has been published in *Journal of Clinical Psychology* (Millman, Hunter, Orgs, David, & Terhune, 2021).

In Chapter 4, I collected the data, conducted the analyses, and led the writing of the manuscript. Devin Terhune helped design the study and assisted with manuscript writing and editing. Elaine Hunter, Anthony David, and Guido Orgs also assisted with editing. The manuscript has been published in *Psychiatry Research* (Millman, Hunter, David, Orgs, & Terhune, 2022).

In Chapter 5 and Chapter 6, I designed the studies, collected all of the data, conducted the analyses, and wrote the manuscripts. Guido Orgs, Devin Terhune, and Elaine Hunter supervised and contributed to the design of the studies and assisted with the editing of the manuscripts. The manuscript for Chapter 5 has been submitted for publication.

I am the sole author of Chapter 7.

1. Introduction

1.1 Depersonalization-derealization disorder

Depersonalization denotes “a state in which the sense of self and the quality of subjective first-person experience are oddly altered” (Medford, 2012, p. 3). Pronounced disconnections from the self are defined as depersonalization, whereas disconnections from external reality are defined as derealization (American Psychiatric Association, 2013). Depersonalization and derealization fall under the broader category of dissociation, which may manifest as a disconnection from, or alteration of, one’s identity, consciousness, and memory (DSM-5; American Psychiatric Association, 2013). Transient, short-lived experiences or mild episodes of depersonalization-derealization are relatively common in the general population, with an estimated prevalence of 23% (Simeon, 2004), occurring in response to fatigue, trauma, or substance abuse (Hunter, Sierra & David, 2004). These types of symptoms are often theorized to act as a self-defense mechanism, protecting the individual from being fully engaged with the triggering situation or event (Shilony & Grossman, 1993; Simeon & Abugel, 2006). When these symptoms shift from transient to chronic, resulting in associated distress and functional impairment, this may lead to a diagnosis of *Depersonalization-Derealization Disorder* (DDD). This shift has been hypothesized to occur as a result of catastrophic misinterpretations of what would otherwise be short-lived depersonalization-derealization symptoms (Hunter et al., 2003).

DDD affects approximately 1% of the general population (Hunter et al., 2004; Deane, Miller, & Wilkinson, 2021; Yang, Millman, David, & Hunter, 2022) with onset most commonly in adolescence or early adulthood (Baker et al., 2003). This disorder evokes questions regarding the sense of self, reality, and phenomenology of experience (Hunter et al., 2005; Medford, 2012). Despite a relatively high prevalence rate, the disorder remains widely unknown and underdiagnosed. DDD comprises a diverse array of symptoms including physiological or emotional numbing, sensory impairments, feelings of detachment and disembodiment, distorted experience of time, feeling as if one is in a dream, visual perceptual distortions, and an unreal or absent sense of self (Simeon & Abugel, 2006). Importantly, those affected by this psychiatric condition do not experience psychosis and have intact reality testing (American Psychiatric Association, 2013) in that they know their experience is atypical and a subjective phenomenon (Hunter et al., 2003). Yet, there is a striking change in the nature of their personal experience. Symptoms of depersonalization and derealization may be observed in other psychiatric disorders including anxiety disorders such as posttraumatic stress disorder (PTSD) and panic disorder, as well as depression and schizophrenia (Hunter, Sierra, & David, 2004).

DDD is classified as a dissociative disorder in both the *Diagnostic and Statistical Manual* of the American Psychiatric Association (DSM-5; American Psychiatric Association, 2013), alongside *dissociative identity disorder* (DID) and *dissociative amnesia*, and in the ICD-11 (World Health Organization, 2018). Although DID and dissociative amnesia are typified by compartmentalization symptoms (Holmes et al., 2005; Brown, 2006), DDD is primarily characterized by detachment pertaining to the self (depersonalization) or to one's environment (derealization). These categories encompass different symptoms and clinical conditions and are hypothesized to arise from independent mechanisms (Holmes et al., 2005; Brown, 2006; Sierra and Berrios, 1998). Compartmentalization symptoms involve the fragmentation of processes that are normally integrated, such as dissociative amnesia, identity disturbances and functional neurological symptoms (Holmes et al., 2005; Brown, 2006; Cardeña, 1994). By contrast, detachment symptoms are characterized by disruptions in the integration of conscious awareness including discontinuities in experience and the perceived separation from the self, body, and one's surroundings (Holmes et al., 2005; Brown, 2006). This symptom demarcation amounts to a fissure within dissociative psychopathology and places DDD in a unique position with regard to other dissociative disorders given its symptom profile not reliably encompassing the full spectrum of dissociative symptoms (Lyssenko et al., 2018) and being primarily detachment-based. This is in contrast to other dissociative disorders including DID, as well as PTSD, functional neurological disorder (FND), and borderline personality disorder, which all involve higher levels of general dissociative symptoms, including both compartmentalization and detachment, compared to DDD (as indexed by the Dissociative Experiences Scale [DES], Carlson and Putnam, 1993; Lyssenko et al., 2018).

Beyond these two categories of dissociative symptoms, another classic feature of dissociative disorders is suggestibility, or the capacity to respond to direct verbal suggestions. The available evidence suggests that elevated suggestibility is selective to dissociative psychopathology as it is not observed in anxiety disorders (Spinhoven et al., 1991) or schizophrenia (Frischholz et al., 1992; Pettinati et al., 1990), with a recent meta-analysis further revealing moderate-to-large effect sizes of elevated hypnotic suggestibility compared to controls in DID, mixed dissociative disorders, FND, and trauma and stressor-related disorders (Wieder et al., 2022). If suggestibility is a cognitive feature of dissociative psychopathology in general, then one would expect it to also be elevated in DDD as is the case in other dissociative disorders. On the other hand, as responsiveness to verbal suggestions is often conceptualized as a form of compartmentalization (Holmes et al., 2005; Brown, 2006), it may be the case that suggestibility selectively accompanies compartmentalization symptomatology and thus should not be observed in DDD (Wieder et al., 2022; Dell, 2019). Uncovering whether or not this is the case, as will be done in this thesis, would allow for a better understanding of where DDD fits within the dissociative disorders psychopathology. An added benefit to examining suggestibility in this population is that this variable may also predict placebo responding (Parsons, Bergman, Wiech, & Terhune, 2021; Corsi & Colloca, 2017), which has potential indirect implications for the use of psychological interventions in this condition.

The symptom differences seen in DDD as compared to other dissociative disorders are potentially attributable to differential aetiologies: whereas trauma exposure has been considered a primary antecedent of dissociative disorders and PTSD (Dalenberg et al., 2012), it seems to be implicated in a smaller proportion of DDD cases, corresponding to ~40% (Baker et al., 2003; Michal et al., 2016; Millman et al., 2021; Simeon et al., 2003). Other precipitating factors can include drug use, particularly marijuana, ecstasy, or hallucinogens, depression, anxiety, or a period of extreme stress (Hunter et al., 2003; Soffer-Dudek 2014; Madden & Einhorn, 2018).

It is clear that DDD is characterized by heterogeneity comprising diverse symptomatology that overlaps with both anxiety and other dissociative disorders. DDD patients experience cognitive symptoms of increased arousal alongside subjective deficits in concentration and attention, as seen in anxiety disorders (Wells & Matthews, 1994; see also Hunter, Phillips, Chalder, Sierra & David, 2003; Hunter, Salkovskis & David, 2014). Case series conducted by Baker et al. (2003), Simeon, Knutelska, Nelson and Guralnik (2003), and Michal et al. (2016), report high levels of comorbid anxiety in individuals with DDD. Moreover, DDD differs from other dissociative disorders, with disturbances of memory observed less frequently (e.g., Lyssenko et al., 2018). This symptom overlap, and the high comorbidity of DDD with anxiety disorders (Sierra, Medford, Wyatt & David, 2012), implies an intrinsic link between DDD and anxiety. Collectively, these disparate lines of research strongly suggest that DDD is distinct from the dissociative disorders, with differing phenomenology, aetiology, and mechanisms. The assessment of the heterogeneous symptomatology that is present in DDD, which will be explored in this thesis, will help to better understand the extent to which this patient population is made up of discrete subgroups of individuals that experience varying levels of detachment, compartmentalization, including suggestibility, and anxiety symptoms. These subgroups may then be more or less aligned with other dissociative disorders or anxiety disorders, with potential implications for directing tailored treatment.

1.2 Evidence-based treatment for depersonalization-derealization disorder

Existing therapies for DDD are by and large talking therapies including Cognitive Behavioural Therapy and psychodynamic therapies (Patrikelis et al., 2021). To date, Cognitive Behavioural Therapy (CBT) has shown success as a primary treatment of choice for DDD where the identification and correction of thinking patterns and changing nonadaptive behavioural patterns produce symptom change (Hunter, Baker, Phillips, Sierra & David, 2005). Hunter et al. (2003) proposed five strategies to decrease symptoms of depersonalization: psychoeducation and normalizing, diary keeping, reducing avoidance, reducing self-focused attention, and challenging catastrophic assumptions. An open study with 21 DDD patients individually treated with CBT, using these five strategies, did find improvements in all outcome measures including depersonalization-derealization symptom severity, anxiety, depression, and general functioning (Hunter et al., 2005). Though this is promising, it was suggested that the improvement in depersonalization-derealization symptoms may actually have been heavily tied to the reductions in depression and anxiety seen with the CBT. By this reasoning, CBT as an efficacious treatment for depression and anxiety may then indirectly alleviate detachment symptoms (Hunter et al., 2005). Overall, evidence-based treatment for DDD often includes case studies (Weber, 2020) and small sample sizes (Fluckiger, Schmidt, Michel, Kindler, & Kaess, 2022), and any randomized controlled trials performed evaluating pharmacotherapy (e.g. fluoxetine, lamotrigine) or psychotherapy (e.g. CBT, psychodynamic psychotherapy, biofeedback) reveal either a lack of efficacy of the treatments or inconsistent evidence across them (Somer, Amos-Williams & Stein, 2013; Sierra, Phillips, Ivin, Krystal & David, 2003). Although some suggestions have been made with regard to future directions for treatment, including adaptive immersive virtual environments (Patrikelis et al., 2021), there is an obvious and current need for controlled research on therapeutics for DDD.

A core feature of DDD is the experience of physiological numbing and a sense of detachment between one's sense of self and their body (Ciaunica, Hesp, Seth, Limanowski & Friston, 2021), where feelings of disembodiment and a lack of awareness of the body are present. Talk therapies or more verbally grounded treatments may be less likely to address this fundamental aspect of the disorder. In the case of DDD, one can stipulate that a lack of bodily awareness is thought to play a role in the experience and maintenance of their symptoms. More embodied therapies, like Dance Movement Therapy (DMT) which will be discussed in greater detail later in this Chapter and put forward as a treatment tool within this thesis, may help to more directly and effectively access mental illness that is rooted in the body by *generating* bodily experiences rather than *discussing* their absence or alteration. Allowing the individual to re-focus and ground themselves both in their internal and external reality, and re-establish a sense of self, seems to be fundamental to treating this type of disorder and is perhaps a missing piece in traditional talk therapies or pharmacotherapy. For example, Jorba-Galdos (2014), with a goal towards developing DMT interventions for the treatment of compartmentalized dissociation (CD), explores links between creativity and CD and proposes the benefits of engaging with the body in the treatment of this type of dissociation. As clearly stated, “If detachment is conceptualized as a separation from a sense of self and/or the environment, treatment should focus on grounding and orientation to the self and the here and now” (Jorba-Galdos, 2014, p. 468). Pierce (2014) has a similar focus, proposing a DMT treatment model for adults with trauma-related dissociative symptoms that includes the use of interventions such as body-to-body relating, self-awareness and expression, and interactional movement. The aim of these interventions is to work from the bottom-up to support the integration of the individual across “dissociated somatic, emotional, and psychological experiences” (Pierce, 2014, p. 7). Both authors (Jorba-Galdos, 2014; Pierce, 2014) make it clear that there are expansive possibilities when it comes to the use of creative or arts interventions for dissociation, which is a central focus of this thesis. The experiences of detachment and disembodiment in DDD (Watson, 2022) may partly reflect altered (Sedeno et al., 2014) or deficient (Seth et al., 2011; Schulz & Vogele, 2015; Ciaunica et al., 2021) interoceptive processing (Gatus, Jamieson, & Stevenson, 2022) and embodiment (Michal et al., 2014; Tanaka, 2018), which may be valuable targets for research and therapeutic interventions including DMT.

1.3 Depersonalization-derealization disorder and embodiment

Goldman and de Vignemont (2009, p. 154) define embodiment as the “mental representations in bodily formats that have an important role in cognition.” Being embodied means to be in the world as an integrated whole (Watson, 2022; Kiverstein, 2012), and a sense of embodiment is foundational to the experience of the self, agency, feelings of bodily ownership, and self-consciousness (Lopez, Halje, & Blanke, 2007; Gallagher & Vaever, 2004). For many who are diagnosed, a core experience of DDD includes consistent feelings of disembodiment (Watson, 2022; Michal et al., 2014, Sierra & David, 2011), or a split between the self and the body (Tanaka, 2018). These may materialize as out-of-body experiences, physiological numbing or somatosensory distortions, and a sense of detachment from the physical body (Michal et al., 2014; Sierra et al., 2005; Gallagher & Vaever, 2004). As suggested by Michal et al. (2014, p. 2), DDD “may be considered as a specific disorder of embodiment” based on the inability to, or difficulty with, integrating bodily feelings and perceptions into a sense of self. Gallagher and Vaever (2004), in their discussion of disorders of embodiment, including DDD, suggest that these types of disorders involve issues with both sense of agency and ownership. As previously suggested, treatments like DMT may more specifically and effectively be able to target feelings of disembodiment and reintegrate the self within the body in these individuals (Jorba-Galdos, 2014). The feelings of disembodiment described in DDD, as well as other disorders of embodiment, may be tied to altered or deficient interoceptive processing (Sedeno et al., 2014; Seth et al., 2011; Seth, 2013; Schulz & Vogele, 2015; Ciaunica et al., 2021). Interoception, which is defined and further explored within the next section of this Chapter, may be a fundamental feature of human embodiment (Herbert & Pollatos, 2012), wherein interoceptive states are the building blocks that contribute to the ‘self’, where the self is grounded in the body.

1.4 Depersonalization-derealization disorder and interoception

Interoception refers to a sense of awareness of one’s own body and its internal states and sensations (Tsakiris & De Preester, 2018). 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). Interoception can be examined according to distinguishable dimensions including interoceptive accuracy (objective performance on behavioural tests of heartbeat or respiration detection), interoceptive sensibility (self-report of experience and subjective beliefs), and interoceptive awareness (metacognitive insights into performance aptitude) (Garfinkel et al., 2015). Interoceptive accuracy is most commonly assessed by heartbeat counting (Schandry, 1981) or heartbeat discrimination (Whitehead, Drescher, Heiman, & Blackwell, 1977) whereas interoceptive sensibility and awareness are typically assessed by self-report measures (Multidimensional Assessment of Interoceptive Awareness – II; MAIA-II, Mehling et al., 2018). Interoception begins with the activation of ergoreceptors – specialized receptor cells that are capable of sensing the body's internal state (Fogel, 2009 in Hindi, 2012). Information that activates these receptors is transformed to neural signals that are then sent to the brain via the spinal cord (Fogel, 2009 in Hindi, 2012). Brain areas receiving this information include the amygdala, thalamus, hypothalamus, insular cortex, anterior cingulate cortex, and orbitofrontal cortex (Critchley et al., 2004; Fogel, 2009; MacDonald, 2007; all in Hindi, 2012). We don't consciously experience all internal sensory data (for example, breathing) but sensory data is capable of being accessed "by bringing attention to sensory properties of the involuntary movement" (Hindi, 2012, p. 131).

There is mounting evidence for the role of heart-focused interoception in decision-making, emotional experience, and clinical disorders (Schulz, 2016) with a consistent thread through neuroimaging research examining interoception and corresponding brain regions. 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 (Seth, 2013; Levine & Land, 2016; Dieterich-Hartwell, 2017; Tsakiris & De Preester, 2018; Quadt, Critchley, & Garfinkel, 2018). Schulz (2016), Seth (2013) and Damasio and Carvalho (2013) review evidence suggesting 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). In the particular case of DDD, 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 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. Further, work by Sedeno et al. (2014), Owens et al. (2015), and Schulz and Vogele (2015) provides evidence for deficits in interoception, abnormal cardiovascular sympathetic and parasympathetic responses to physical and emotional stimuli, and changes in the cortical representation of bodily signals in DDD patients. By contrast, other studies question a direct link between DDD and impaired interoception. For example, Michal et al. (2014) report that those with DDD show 'normal' interoceptive accuracy as measured by heartbeat detection and heartbeat counting tasks (Schandry, 1981; Whitehead et al., 1977) despite reporting severe anomalous bodily experiences. Given this, it is important to continue the exploration of interoception in DDD, particularly better understanding the relationships between the aforementioned dissociable dimensions (Garfinkel et al., 2015; Suksaslip & Garfinkel, 2022).

Another important concept in relation to interoception is mindfulness, defined as "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). Previous research has demonstrated that therapeutic interventions including Mindful-Awareness in Body-Oriented Therapy (MABT; Price and Hooven, 2018), Qigong and Tai-Chi (Yeung et al., 2018), or Somatic Experiencing (Payne et al., 2015), can focus attention on interoceptive stimuli (Joshi, Graziani & Del-Monte, 2021). After a 7-week Mindfulness Oriented Meditation training, healthy individuals displayed increased mindfulness and interoceptive awareness alongside reduced dissociative tendencies (D'Antoni et al., 2022). Further, the more their mindfulness skills increased, the more their interoceptive awareness improved and dissociative experiences decreased. Mindfulness has been shown to be reduced in DDD (Michal et al., 2013; Nestler, Sierra, Jay & David, 2015) which may be linked to the previously suggested deficits in interoceptive awareness. Mindfulness interventions encourage individuals to pay attention to and become more aware of being in the present moment (Kabat-Zinn, 2003) and previous research has recommended training in mindfulness techniques as a potential therapeutic approach for DDD (Nestler et al., 2015), with indications that mindfulness exercises, specifically mindful breathing, can immediately reduce present state depersonalization in patients with DDD (Michal et al., 2013). Arguably, a mindful state thus stands in direct contrast to dissociation (Zerubavel & Messman-Moore, 2015).

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. Interoception may be an important "mechanism of action in improving clinical symptomatology" (Khoury, Lutz, & Schuman-Olivier, 2018, p. 1). That being said, one may assume that disorders with an interoceptive and embodied component, such as DDD, may be a very good target for treatments involving the physical body. One form of physical activity that could be particularly useful in potentially altering interoceptive processing and enhancing interoceptive awareness and mindfulness in DDD is Dance Movement Therapy (DMT; Cruz, 2016). If DDD is indeed linked to reduced awareness of bodily sensations, it may be more directly and effectively addressed by *generating* mindful body movements and experiences rather than *discussing* their absence. DMT could be an ideal route to achieve this and will be proposed as such within this thesis.

1.5 History and background of Dance Movement Therapy

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" (ADTA, 2014, What is dance/movement therapy?). 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 and 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 also 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 3000 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.

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 (ADTA, 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: (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 micro-movements 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*: 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 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 wellbeing 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 (Cruz, 2016). 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 *Body Psychotherapy* (BPT). Taking a psychodynamic approach, BPT combines “specific body-oriented, non-verbal interventions with insight-oriented, verbal techniques to obtain behaviour 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.).

Physical exercise more broadly has shown a wide range of benefits for mental health (Taylor, Sallis, & Needle, 1985; Mikkelsen, Stojanovska, Polenakovic, Bosevski, & Apostolopoulos, 2017; Chekroud et al., 2018). However, dance, more specifically, uniquely combines cognitive, social, and fitness components. In studies comparing physical exercise to dance, it is the dance interventions that have been shown to significantly reduce levels of anxiety (Leste & Rust, 1984), improve white matter integrity (Burzynska et al., 2017), and decrease depression, negative mood, and loneliness, whilst improving daily functioning (Ho et al., 2020). Further, a systematic review and meta-analysis of dance interventions on physical health outcomes compared to other types of physical activity (Yan et al., 2017) revealed that participation in a range of genres of structured dance “is equally and occasionally more effective than other types of structured exercise for improving a range of health outcome measures” (p. 933). As such, dance is a potentially valuable intervention to prevent or treat physical and cognitive decline (Verghese et al., 2003).

1.6 Effectiveness of DMT

Many studies on the effectiveness of DMT have been conducted with individuals with diverse physical illnesses, medical, and neurological conditions. These studies typically assess measures of wellbeing and mood change, depression scores or other psychological outcomes pre- and post-intervention. Specifically, DMT has been used to improve wellbeing in patients diagnosed with breast cancer (Goldov, 2011; Sandel et al., 2005), dementia (Hokkanen et al., 2008, Ho et al., 2018), fybromyalgia (Bojner Horwitz et al., 2006; Bojner Horwitz, Kowalski & Anderberg, 2010), brain trauma (Berrol, 2009), hypertension (Aweto et al., 2012), Parkinson's disease (Earhart, 2009; Kiepe, Stockigt, & Keil, 2012; Hackney, Kantorovish, Levin & Earhart, 2007; Abraham, Hart, Andrade & Hackney, 2018), cystic fibrosis (Goodill, 2005), and Alzheimer's disease (Dayanim, 2009). DMT has been shown to improve a range of mental health and wellbeing measures including mood, vitality, self-efficacy/coping, body image, and anxiety (Goodill, 2006 in Koch, 2007). This cumulative set of studies provides support for the use of DMT for health-related psychological outcomes and wellbeing 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 et al., 2014; Koch et al., 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 remains sparse in comparison. Although systematic reviews and meta-analyses specifically examining DMT for clinical mental health diagnoses have been reported for depression (Mala, 2012; Meekums, 2015; Karkou et al., 2019) and schizophrenia (Ren & Xia, 2013), these reviews were 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 my knowledge, only 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. One step forward in terms of better understanding how and why DMT may be successful would be the manualization of treatment. The manualization of DMT protocols will not only help unpack the specific mechanisms at play but will also facilitate replication and generalization and improve validity.

1.7 Manualization of treatment

As previously suggested (Koch et al., 2014; Meekums, Karkou & Nelson, 2015; Karkou, Aithal, Zubala & Meekums, 2019), 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 then 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, Riege, Tisborn & Biondo, 2019). Although there are certain subtypes of DMT, such as *Primitive Expression* or the *Chacian approach*, there have yet to be well-used, standardized interventions tailored to specific psychological or physical disorders and symptoms. One starting point might be to conduct studies comparing widely used DMT interventions such as the *Chacian approach*, *Primitive*

Expression, 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 step forward in gaining a better understanding of the mechanisms by which DMT can work. A main goal within the research presented in this thesis has been to develop standardized dance tasks for DDD to not only work towards the manualization of DMT treatment, but also to help pull apart the precise elements by which the tasks may be effective. 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, dissociation in depersonalization-derealization disorder, etc.). An important step forward in relation to this would be examining (dis)embodiment from the perspective of cognitive neuroscience.

1.8 Cognitive and brain mechanisms of DMT

Although previous research offers 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 I 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.

1.8.1 Embodiment

DMT practitioners and researchers often make reference to embodiment, but, with the exception of a few studies (Martin, Koch, Hirjak & Fuchs, 2016; Hildebrandt, Koch & Fuchs, 2016; Mastrominico, 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 et al., 2012). For example, Warburton, Wilson, Lynch and Cuykendall (2013) showed that dancers use a technique called ‘marking’ to aid with the 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 better performance (Warburton, Wilson, Lynch & Cuykendall, 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, Sivarajah and Calvo-Merino (2016) explored how dance training and expertise modulates emotional processes. Professional ballet dancers, as compared to 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 non-dancers, 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 et al., 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, Gaigg & Calvo-Merino, 2017). Interoceptive accuracy was compared between professional ballet dancers and a matched control group of non-dancers 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 five weeks of creative dance training whereas the other 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, with no differences seen on measures of motor performance or cognitive processing speed.

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, Wilson, Lynch & Cuykendall, 2013). Though DMT interventions are unlikely to generate expertise levels comparable to professional dancers, much research has shown that dance training changes behaviour and brain function within weeks and sometimes even days of practice (Kirsch & Cross, 2015; Cross, Kraemer, Hamilton, Kelley & Grafton, 2009). It is possible, then, that some of the benefits of DMT are mediated by the mechanisms described above. 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 DMT research and treatment.

1.8.2 Interoception

As previously discussed, interoception is a sense of awareness of the body and its internal states and sensations (Tsakiris & De Preester, 2018). 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 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.

Toward this end, Dieterich-Hartwell (2017) presents a DMT application model based on the assumption that an improvement in interoception is central to psychological well-being. Increased 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, Pylvanainen and Lappalainen (2018) highlight the need for further studies investigating the core processes in DMT that are responsible for changes in mood and psychological wellbeing.

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 interoceptive awareness and accuracy (Schandry, 1981), proprioceptive accuracy (Jola, Davis & Haggard, 2011) and time perception (Wearden, 1991; Orgs et al., 2011, 2013), as will be done in this thesis, 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.

In summary, there is compelling evidence for continued and focused research, cognitively grounded in concepts such as interoception, on the mechanisms by which DMT has an effect. There is also a need for the development of specific, controlled, and standardized interventions, tailored to individual mental health disorders. Although it is clear that DMT can be beneficial across a range of illness and disorders, it is important to move beyond the movement-emotion correlation. Perhaps using the body through movement to first and foremost inform the physical body, where the self is grounded, and increasing interoceptive awareness in the process, is the first step. This newly informed physical body could then more effectively act to inform the mind and emotions. In the next section, I will discuss new theoretical frameworks of DMT for dissociation and trauma and more specifically the possibility of using DMT as a treatment for DDD.

1.9 Disorder- and symptom-specific, neurocognitive DMT

There is a significant lack of literature in the area of DMT and its application to dissociative disorders including DDD, DID, *dissociative amnesia*, and *compartmentalized dissociation* (CD) as well as developmental trauma or PTSD. This is surprising, as these disorders are often directly characterized by abnormal bodily experiences and sensations, and enhancing bodily awareness and felt presence in the ‘here and now’ is a direct goal of many DMT interventions. Despite this clear link between dissociative symptoms and the focus of DMT interventions, only very few studies have examined whether DMT can be used to ameliorate dissociation.

As previously mentioned, a core feature of DMT is the observation of one’s own body and its physiological and psychological feelings and boundaries. Working in conjunction with research on interoception could be an important initial way to draw in more scientifically grounded and physiologically based concepts and research to DMT. Koch and Harvey

(2012) examine the value of DMT in treatment for traumatized dissociative child and adult patients. They, aligning with other authors and personal perspectives, take the stance that to address trauma that has occurred at the level of the body, therapy should also occur at the level of the body. “Whereas verbal therapies address the emotions from the top down, movement therapy addresses them from the bottom up” (p. 376). The authors highlight the main principles of DMT that are helpful in working with DID patients specifically, which include: grounding, mirroring, building strength and resources, work with body memories, use of metaphors, authenticity, working with resistance, and working with touch.

Jorba-Galdos (2014), noting that research on dissociation and DMT is still limited, provides interesting perspectives on the relationship between creativity and dissociation, more specifically, CD, and includes an exploration of clinical implications for treatment. Pierce (2014) proposes a DMT treatment model, according to a trauma treatment framework, for adults with trauma-related dissociative symptoms. The treatment model consists of three phases: safety and stabilization, integration of traumatic memory, and development of the relational self. These three phases apply a DMT toolbox including body-to-body relating and interactive regulation, self-awareness and expression, and group movement experiences. The International Society for the Study of Trauma and Dissociation (ISSTD) similarly recommends comprehensive treatment approaches that aim to support both psychological and physiological integration (ISSTD, 2005 in Pierce, 2014). Recommended as a next key step would be the development of a manualized DMT intervention model for the treatment of dissociative disorders. This would help in evaluating the efficacy of, and evidence for, this phase-trauma treatment framework.

Dieterich-Hartwell (2017) focuses her paper on the role of interoception in the recovery from trauma and presents a DMT application model that is based on the assumption that an improvement in interoception is central to successful treatment. Like Pierce (2014), her model is also composed of three main steps: safety, regulating hyperarousal, and attending to interoception. Dieterich-Hartwell (2017), alongside Pierce (2014), Jorba-Galdos (2014), and Koch and Harvey (2012) 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.

Based on the research thus far, there appear to be no studies to date exploring whether targeting the potential lack of interoceptive awareness and mindfulness in DDD through DMT, and aiming to increase it, can lead to a decrease in depersonalization-derealization symptoms and inform the development of dance or body-based treatment tools. As presented above, while theoretical frameworks do exist, there are a lack of well-validated treatments or interventions for dissociative disorders and trauma. In this thesis, DDD is presented as a suitable candidate for DMT interventions. Beyond an improvement in interoceptive awareness and mindfulness, the use of dance and movement in this clinical population may also encourage a shift in attentional style.

1.10 Attentional styles and attention to bodily signals

Attentional focus is a central concept in sport and exercise psychology (Bigliassi et al., 2012). To increase endurance and reduce focus on bodily signals of fatigue and exhaustion, professional athletes often employ dissociative strategies, i.e., during running a marathon, focusing on their external surroundings rather than internally on their body. Such a shift from internal to external sensations is known as a dissociative attentional style which can, for example, be achieved by listening to music during exercise (Bigliassi, Karageorghis, Nowicky, Wright, & Orgs, 2017). Conversely, an increase in exercise intensity may cause an attentional shift from an external focus on one's surrounding environment, to an internal focus on the sensations of the body (Bigliassi et al., 2012). It is this shift to a more associative and adaptive attentional style that I worked to develop with the two dance tasks used in the studies presented in the second half of this thesis.

Recent work by Trevisan, Mehling, & McPartland, 2020, has explored the differences between "adaptive" and "maladaptive" forms of interoceptive or self-focused attention. Though attending to the body and having an accurate perception and understanding of what different sensations mean can be widely beneficial (Kabat-Zinn, 2003; Bornemann & Singer, 2017) and promoted through the use of therapeutic practices including Mindfulness-Based Cognitive Therapy (Kuyken et al., 2010), certain disorders are associated with a "hyper-focus on bodily feelings (i.e., heightened interoceptive attention) in search for signs of illness or injury" (Trevisan, Mehling, & McPartland, 2020, p. 242). A body-focused attention has been suggested to play an important role in anxiety-related symptoms and disorders (Bernstein, Zvolensky, Sandin, Chorot & Stickle, 2008, p. 81). There appears to be a fine balance between positively attending to the body and paying too much attention to it, or overanalyzing the sensations being felt (or not felt). Trevisan et al. (2020) have suggested that this relationship is circular wherein heightened anxiety can then lead to intensifying physical signals.

Given the association of DDD with anxiety disorders, as well as my goal of guiding the development of an adaptive, associative attention style, I was also interested in examining the role of body vigilance in DDD. Previous studies have found body vigilance to be positively associated with a range of negative effects including somatization symptoms, negative affectivity, anxiety sensitivity, and panic attacks (Bernstein, Zvolensky, Sandin, Chorot & Stickle 2008). In the studies reported in the second half of this thesis, the body vigilance scale (BVS; Schmidt, Lerew & Trakowski, 1997) was used to assess one's sensitivity to and attentional focus on internal bodily sensations. This questionnaire includes the list of 15 sensations that are the physical symptoms associated with panic attacks (DSM-IV; American Psychiatric Association, 1994). The use of the BVS, in conjunction with measures of interoceptive awareness, allows for the examination of and delineation between adaptive and maladaptive forms of attending to the body (Trevisan et al., 2020) and how these may be altered through DMT.

1.11 Structure of the thesis

The broad aim of this thesis is to generate a better understanding of DDD, a clinical condition that is still widely unknown and underdiagnosed, from a body-based perspective. More specifically, this thesis aims to identify: 1) the current state of the DMT literature for clinical mental health disorders, 2) the neurocognitive concepts involved in DMT including embodiment and interoception, 3) latent subtypes within the broader DDD patient population, 4) the roles of interoception, mindfulness, visual imagery, verbal suggestibility, time perception, and body awareness in DDD, 5) if controlled dance/movement tasks can reduce depersonalization-derealization symptoms and be used as a treatment tool, and 6) if improvements in interoceptive awareness and mindfulness are linked with decreased levels of dissociation.

As described throughout this Chapter, DMT is an embodied, movement-based approach that stands as a potentially valuable intervention for improving physical health and mental wellbeing in a range of physical illnesses, medical, and neurological conditions. Unfortunately, the literature and research exploring DMT for the treatment of clinically diagnosed mental health conditions is sparse in comparison. Because of this, there remain a number of open questions regarding DMT, most especially in relation to *how* this type of therapy achieves its positive results. With a view towards collating relevant research on DMT for psychological disorders and better understanding the evidence-base, Chapter 2 provides an in-depth review of controlled trials of DMT for clinical mental health conditions, highlighting the efficacy of this type of therapy for specific psychological disorders. The Chapter further outlines ways to move this area of research forward, including grounding it in cognitive neuroscience.

The section encompassing Chapter 3 and Chapter 4 is focused on better characterizing and understanding DDD. Although DDD is classified as a dissociative disorder in both the DSM-5 (American Psychiatric Association, 2013) and ICD-11 (World Health Organization, 2018), it is perhaps uniquely placed in this category with regard to other dissociative disorders given the types of symptoms these individuals experience. The symptom profile in DDD does not reliably encompass the full spectrum of dissociative symptoms (Lyssenko et al., 2018) and is instead primarily detachment-based, compared to DID and dissociative amnesia that are typified by elevated compartmentalization symptoms (Holmes et al., 2005; Brown, 2006). DDD is also marked by significant overlap with anxiety disorders, both in terms of comorbidity (Sierra, Medford, Wyatt & David, 2012), as well as cognitive symptoms and subjective deficits (Wells & Matthews, 1994). To help unpack the heterogeneity seen within DDD, examine the possibility of subtypes within the broader DDD diagnosis, and better understand where DDD fits in relation to other dissociative disorders and germane conditions, Chapter 3 presents a latent profile analysis of a large DDD patient dataset. Subgroups may emerge as being more or less aligned with other dissociative or anxiety disorders, with potential implications for directing tailored treatment. Another classic feature of dissociative symptomatology is the capacity to respond to direct verbal suggestions, or suggestibility. Elevated suggestibility is present in dissociative and symptom-adjacent disorders (Wieder et al., 2022), but has yet to be examined within DDD more specifically. Given the symptomatic differences between DDD and the other dissociative disorders, it is a possibility that suggestibility selectively accompanies compartmentalization symptoms and should therefore not be observed in DDD (Dell, 2019). Determining whether or not this is the case will generate a further understanding of the symptom profile/s within DDD and help to determine where DDD fits within dissociative disorders psychopathology. To achieve this, Chapter 4 examines verbal suggestibility and its relationship to depersonalization-derealization symptoms, mindfulness, anxiety, and visual imagery in DDD.

The final section of the thesis focuses explicitly on dance-based therapy for DDD. As explored throughout this Chapter, DDD involves experiences of detachment and disembodiment, which may partly be the result of altered or deficient interoceptive processing (Sedeno et al., 2014; Seth et al., 2011; Gatus, Jamieson, & Stevenson, 2022). Disorders with an interoceptive or embodied component, such as DDD, are likely to benefit from treatments that work from the bottom-up, involving the physical body to more specifically and effectively target feelings of disembodiment and reintegrate the self within the body (Jorba-Galdos, 2014). Since a focal point of DMT or body-based therapies is an interconnection of the mind and body, it may be a particularly useful form of treatment to alter deficient or maladaptive interoceptive processing whilst simultaneously enhancing interoceptive awareness and mindfulness (Cruz, 2016). Within this thesis, DDD is presented as a suitable candidate for dance/movement interventions, with Chapter 5 and Chapter 6 respectively, presenting an online and in-person intervention study implementing dance-based tasks for DDD to decrease depersonalization-derealization symptoms whilst simultaneously improving a sense of awareness of the body. The development and inclusion of standardized dance/movement tasks for DDD within these Chapters not only works towards the manualization of DMT treatment, but also helps to pull apart the precise elements by which the tasks may be effective.

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

2.1 Abstract

Dance/Movement Therapy (DMT) has become an increasingly recognized and used treatment, though primarily used to target psychological and physical wellbeing 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. 15 studies were eligible for inclusion. After reviewing the principal results of the studies, we highlight the strengths and weaknesses of this treatment approach and examine the potential efficacy of using bodily movements as a tool to reduce symptoms. DMT has clear potential as a treatment for a range of conditions and symptoms and thus further research on its utility is warranted.

2.2 Introduction

As described in the previous Chapter, DMT provides a potentially powerful but understudied route to the treatment of psychological disorders as it emphasizes the human body as its primary means of communication and expression. As an embodied, movement-based approach that relies on the interconnection of body and mind (ADTA, 2014), DMT assumes that the physical movements of the body are shaped in part by the affective states of a person wherein changes in one's movement patterns have the potential to facilitate corresponding changes in their psychological and social experiences (Martinec, 2018). 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. Although it is clear that DMT can improve well-being and health-related psychological outcomes in physical illness, medical conditions or neurological conditions (Koch, Kunz, Lykou, & Cruz, 2014; Koch, Riege, Tisborn, & Biondo, 2019), the literature and research exploring the use of DMT as a treatment for clinically diagnosed mental health disorders remains sparse, leaving many open questions regarding DMT. Importantly, the concepts and mechanisms by which DMT works often remain underspecified. This Chapter aims to present an integrative review and synthesis of controlled trials using DMT, highlighting the clinical efficacy of DMT as a treatment tool across specific psychological disorders. 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 identify some of the limitations that research on mechanisms and effectiveness of DMT currently faces. We conclude by outlining existing challenges and further directions for research on cognitive mechanisms and the effectiveness of DMT.

2.3 Methods

2.3.1 Search Strategy

A broad literature search was undertaken, following PRISMA guidelines for systematic reviews (Moher, Liberati, Tetzlaff, Altman & The, 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. Full text of the remaining papers were then reviewed to determine eligibility. A flow diagram of the study screening process is presented in **Figure 2.1**.

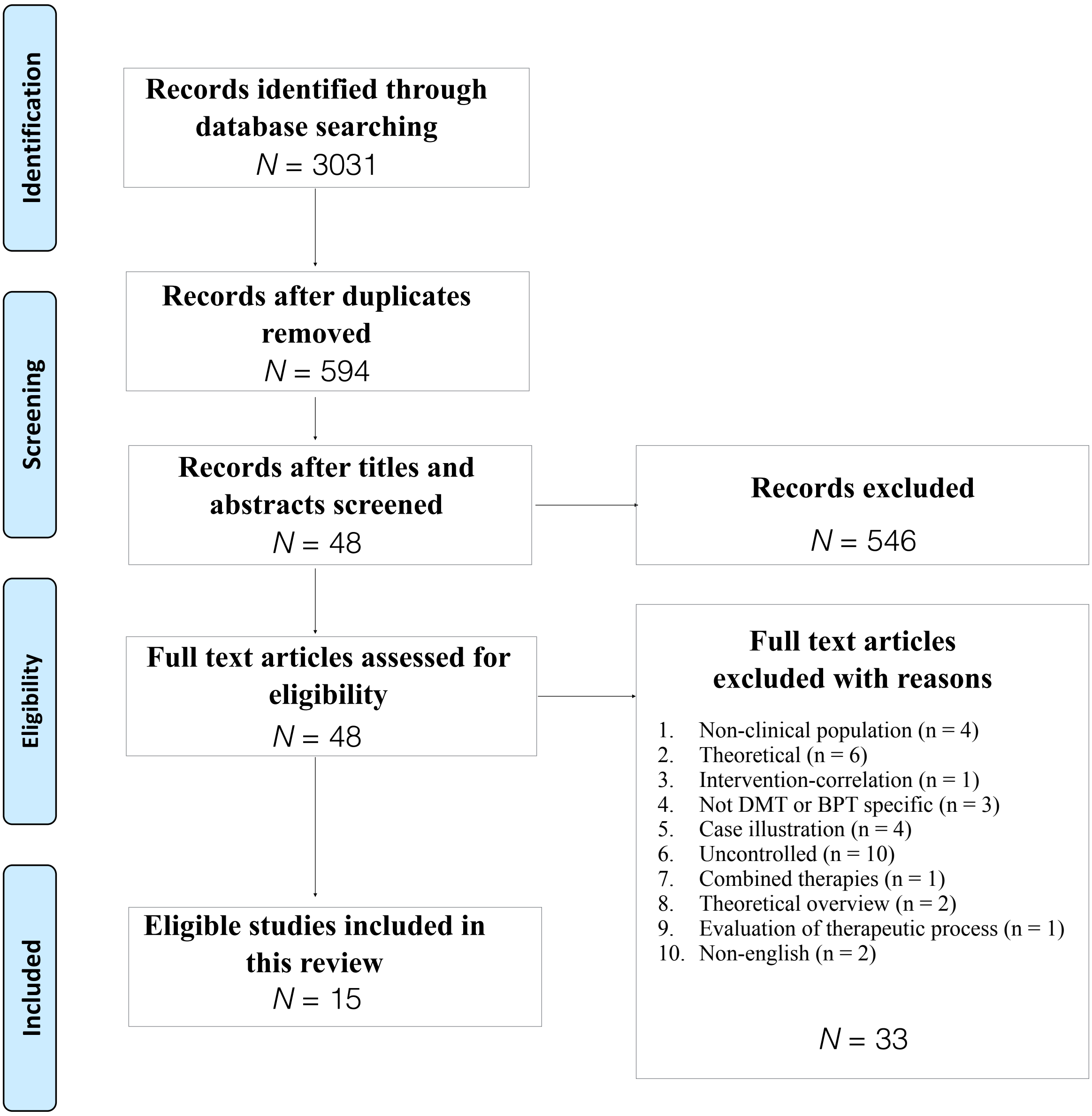
2.3.2 Inclusion and Exclusion Criteria

Studies included in this review were required to meet the following inclusion criteria: 1) randomised controlled trial (RCT) or controlled trial, 2) conducted and published after 2004, 3) group intervention, 4) involving a clinically diagnosed mental health population, 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.

2.3.3 Data Extraction

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.

Figure 2.1. PRISMA Flow Diagram.



2.3.4 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.

2.3.5. 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' *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' *g* was calculated by subtracting the post-treatment mean from the pre-treatment mean, and then dividing this by the pooled and weighted *SD.*

2.4 Results

2.4.1 Study Characteristics

This 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 2.1**. 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 (Rohricht, 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 16-66 and an average age of 36.7. 12 of the 15 included studies were randomised controlled trials and the remaining three were controlled trials.

2.4.2 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 SCL-90-R (Global Severity Index: within-group d = .33; Positive Symptoms Total: within-group d = .32; Positive Symptoms Distress Index: within-group d = .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 x time interactions were present in both cases (serotonin: 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, Morlinghaus & Fuchs, 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; or 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 to the music-only (d = 1.28) and movement-only (d = .90) control groups. Those in the DMT condition also showed a significant increase in vitality as compared to

Table 2.1 Summary of study characteristics.

Author	Year	Nationality of Sample	Diagnosis	*N*	Age (*M*)	Assignment to condition	Intervention/ Manualisation	Individual vs group	Control group	Length & Frequency of treatment	Outcome measures
Jeong et al.	2005	South Korean	Depression	40	16	Randomized	DMT	Group	Waiting list	3 x 45min sessions across 12 weeks, 3 sessions/week	SCL-90-R Plasma serotonin and dopamine concentrations
Rohricht and Priebe	2006	United Kingdom	Schizophrenia	45 BPT = 24 control = 21	BPT = 38.3 SC = 37.7	Randomized	DMT + TAU	Group – max 8 patients	Supportive Counseling (SC) + treatment as usual (TAU)	20 x 60-90min sessions across 10 weeks, 2 sessions/week	PANSS, MANSA
Koch, Morlinghaus and Fuchs	2007	German	Depression	31	42.7 Range = 21-66	Randomized	DMT	Group	Music-only condition OR Movement-only condition (home trainer bike)	One group session, 20-30mins	HBS, Gait velocity, Therapy ranking
Rohricht, Papadopoulos and Priebe	2013	British	Depression	31 (21 received allocated intervention; 10 did not attend)	46.9	Randomized	Body Psychotherapy (BPT)	Group – max 8 patients	Waiting list reciving treatment as usual (TAU)	20 x 90min sessions across 10 weeks + treatment as usual	Primary outcome: HAM-D Secondary outcomes: SES, MANSA
Pylvanainen, Muotka and Lappalainen	2015	Finnish	Depression	33 DMT = 21 TAU = 12	41 Range = 20-29	Self-selection	DMT + TAU	Group – max 4-7 patients	Treatment as usual (TAU)	12 x 90min sessions across 12 weeks + TAU	BDI-II, HADS, SCL-90, CORE-OM

Table 2.1 Continued.

Author	Year	Nationality of Sample	Diagnosis	*N*	Age (*M*)	Assignment to condition	Intervention/ Manualisation	Individual vs group	Control group	Length & Frequency of treatment	Outcome measures
Lee, Jang, Lee and Hwang	2015	South Korean	Schizophrenia	38 DMT = 18 control = 20	DMT = 41.5 control = 41.8	Randomized	DMT + medical treatment	Group	Medical treatment only	12 x 60min sessions across 12 weeks	STAXI, BDI, STAI, PANSS
Koch et al.	2015	German	Autism	31 DMT = 16 Control = 15	22.0 Range = 16-47	Random assignment not possible due to logistics	DMT	Group – max 4-10 patients	No intervention	7 x 60min sessions across 7 weeks	HIS, FBT, EES, Evaluation of mirror qualities of the movement
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	Synchronization -based Dance Movement Intervention (SI-DMI)	Group – max 4-10 patients	Control movement intervention (CMI) focusing on motor coordination	SI-DMI: 10 x 90min sessions across 3 months	MET, IRI, ASIM
Martin, Koch, Hirjak and Fuchs	2016	German	Schizophrenia	68 DMT = 44 TAU = 24	DMT = 41.05 TAU = 37.52	Randomized	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	2016	German	Autism	78	22.5 Range = 14-53	Randomized	DMT	Group - max 10 patients	Waiting list	10 x 60min sessions across 10 weeks	SANS

Table 2.1 Continued.

Author	**Year**	**Nationality of Sample**	**Diagnosis**	***N***	**Age (*M*)**	**Assignment to condition**	**Intervention/ Manualisation**	**Individual vs group**	**Control group**	**Length & Frequency of treatment**	**Outcome measures**
Priebe et al.	2016	British	Schizophrenia	275 BPT = 140 Pilates = 135	42.2	Randomized	Manualised BPT	Group	Pilates class	20 x 90min sessions across 10 weeks, 2 sessions/week	PANSS, SAS Secondary outcomes: measures of psychopathology, functional, social, service use and treatment satisfaction outcomes
Bryl	2018	American	Schizophrenia	31 (28 for analyses)	DMT = 44.67 TAU = 48.38	Randomized	DMT	Group	Standard care	20 x 60min sessions across 10 weeks, 2 sessions/week	PANSS, BNSS, WHO-DAS 2.0, SDS, Semi-structured exit interviews
Mastrominico	2018	German	Autism	57 DMT = 35 Control = 22	22.5 Range = 14-52	Randomized	DMT	Group – max 5-10 patients	Waiting list	10 x 60min sessions across 10 weeks	CEEQ, IRI subscale (Empathic Concern), GO, BSE, EIS
Winter et al.	2018	British	Depression	23 BPT = 11 Control = 12	BPT = 48.36 Control = 48.08	Randomized	BPT + TAU	Group	Waiting list (BPT after 12 weeks)	20 x 90min sessions across 10 weeks	Repertory grid technique (Fransella et al., 2004), MANSA, HAMD-21, Clinical global impression severity of illness (Guy, 1976), RSE, VAS on body cathexis

Table 2.1 Continued.

Author	Year	Nationality of Sample	Diagnosis	*N*	Age (*M*)	Assignment to condition	Intervention/ Manualisation	Individual vs group	Control group	Length & Frequency of treatment	Outcome measures
Rohricht, Sattel, Kuhn and Lahmann	2019	German	Somatoform disorder	24 Manualised BPT or TAU = 16 BPT = 8	BPT = 51.6 TAU = 47.1 waiting group)	Randomized	Manualised BPT for Somatoform Disorder (SD)	Group – max 10 patients	Treatment as usual (TAU)	20 x 90min sessions across a 4-6 month period (one session per week)	PHQ-9, SOMS-7, SF-36, DBIQ, The Helping Alliance Scale

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

the music-only group (*d* = .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, Rohricht, Papadopoulos, and Priebe (2013) evaluated the effectiveness of BPT in patients with chronic depression. Participants were randomly allocated to either immediate manualised 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 to wait-list controls (*g* = .95). No significant differences were observed for self-esteem and quality of life.

Working with a subset of patients from the RCT conducted by Rohricht, Papadopoulos, and Priebe (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 nonsignificant 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.

Pylvanainen, 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 to the treatment as usual group across the study period (between-group differences ranging from *d*s = .60 - .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 three-month follow-up indicate medium to large effect sizes ranging from *d*s = .62 - .82 in the DMT group as compared to small effect sizes ranging from *d*s = .15 - .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-significant 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.

2.4.3 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 = .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 (PANSS negative symptoms subscale) 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 six-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, jerky movements) including both at the end of treatment (d = 0.26) and at the six-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 to 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 = .15). Further, an analysis of 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 = .88), state anger (d = .61) and ability to control anger (d = .53) as compared to 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 randomized controlled trial, Martin, Koch, Hirjak and Fuchs (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 = .39) including subscale measures of blunted affect (r = .31) and deficits in attention (r = .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.

2.4.4 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 .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 et al. (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 = .62), self-other awareness (d = .72), psychological wellbeing (d = .68), and social skills (d = .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 ($d = .47$), asynchrony ($d = -.63$), imitation/synchronization ($d = 1.27$), and reciprocity/dialogue ($d = 1.25$), as compared to the controlled movement intervention (CMI) group in emotion inference ($d = -.04$), automatic imitation ($d = -.03$), asynchrony ($d = .13$), imitation/synchronization ($d = -.47$), and reciprocity/dialogue ($d = -.16$). In line with the research above (Mastrominico et al., 2018; Koch et al., 2015), 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 toward symptom reduction (Hildebrandt, Koch & Fuchs, 2016) as well as improvements in areas including body awareness, emotion inference, self-other awareness, and imitation synchronization (Koch et al., 2015; Koehne, Behrends, Fairhurst, & Dziobek, 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.

2.4.5 Somatoform Disorder

Rohricht, Sattel, Kuhn and Lahmann (2019) implemented a group body psychotherapy manual, including the activation of resources and strengthening of self-regulation, for 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 ($g = .51$) and subjective quality of life significantly increased ($g = .66$) in the BPT-SD group compared to the treatment as usual group (somatic symptoms $g =$

-.23; quality of life *g* = -.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.

2.5 Limitations of Dance Movement Therapy 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 (Pylvanainen, Muotka, & Lappalainen, 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 to wellbeing 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 2.1**, 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, Koch, & Fuchs, 2016; Martin, Koch, Hirjak, & Fuchs, 2016; Rohricht, Sattel, Kuhn, & Lahmann 2019; Rohricht &

Priebe, 2006; Rohricht, Papadopoulos, & Priebe, 2013; Jeong et al., 2005; Pylvanainen, Muotka, & Lappalainen, 2015; Mastrominico et al., 2018; Lee, Jang, Lee, & Hwang, 2015; Bryl, 2018; Koehne, Behrends, Fairhurst, & Dziobek, 2015; Winter et al., 2018). Hildebrandt, Koch and Fuchs (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, Riege, Tisborn, & Biondo, 2019). Karkou, Aithal, Zubala and Meekums (2019) propose that studies should include an active control group of another, readily available, 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 (Priebe et al., 2016; Koehne, Behrends, Fairhurst, & Dziobek, 2015; Koch, Morlinghaus, & Fuchs, 2007), 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. 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 (Pylvanainen, Muotka, & Lappalainen, 2015; Rohricht & Priebe, 2006; Mastrominico et al., 2018; Rohricht, Sattel, Kuhn, & Lahmann, 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 Kohene 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 wellbeing in individuals with Parkinson's or dementia, for example; Abraham et al., 2018; Ho et al., 2018) involved any psychophysiological or neural measures. 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 incorporation of implicit neural, physiological, and behavioural measures such as mobile EEG, interoceptive awareness and accuracy (Schandry, 1981), proprioceptive accuracy (Jola, Davis, & Haggard, 2011) and time perception (Wearden, 1991; Orgs et al., 2011, 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. Grounding DMT in cognitive neuroscience does not just provide a theoretical framework but also new and innovative measures of its effectiveness.

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 [Rohricht, Papadopoulos, & Priebe, 2013]; depression [Winter et al., 2018]; schizophrenia [Martin et al., 2016]; negative symptoms in schizophrenia [Priebe et al., 2016]; somatoform disorder [Rohricht, Sattel, Kuhn, & Lahmann, 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. The particular dysfunctional cognitive mechanisms of the individual disorder could then be addressed with controlled interventions tailored to those mechanisms.

2.6 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 is necessary to integrate traditional methods of DMT with contemporary cognitive neuroscience research on embodiment and interoception.

Characterizing DDD

It is clear that DMT is an important potential treatment avenue for a range of clinical mental health disorders. As discussed, the mechanisms underlying the efficacy of DMT may include interoception and embodiment, two areas that are implicated in DDD. However, prior to delving into the use of dance/movement interventions as a treatment tool for DDD, it is important to first provide further background on, and better characterize, this clinical condition given its heterogeneity and unique placement with regards to other dissociative disorders. To help to better understand and unpack the symptomatic and aetiological heterogeneity seen within DDD, Chapter 3 presents a latent profile analysis on a large DDD patient dataset to identify possible subtypes within the broader DDD diagnosis. The emergence of subtypes that experience different categories or levels of dissociative and anxiety symptoms has potential implications for directing tailored treatment. Since another common feature of dissociation is elevated suggestibility, an assessment of whether or not this is also present in DDD will provide further insight into the symptom profile/s within this clinical condition and their relationship to other psychiatric disorders. To achieve this, Chapter 4 examines non-hypnotic verbal suggestibility and its relationship to depersonalization-derealization symptoms, mindfulness, anxiety, and visual imagery in DDD relative to clinically healthy controls to better parse out whether atypical responsiveness to suggestions is present in DDD, as is seen in other dissociative disorders and germane conditions. Both of these Chapters have implications for the aetiology and treatment of DDD, as well as its classification as a dissociative disorder in psychiatric nosology.

3. Symptom variability in depersonalization-derealization disorder: A latent profile analysis

3.1 Abstract

Depersonalization-derealization disorder (DDD) is characterized by diverse symptomatology overlapping with anxiety and dissociative disorders, but the sources of this variability are poorly understood. This study aims to determine whether symptom heterogeneity is attributable to the presence of latent subgroups. We applied latent profile analysis (LPA) to psychometric measures of anxiety, depersonalization-derealization, and dissociation in 303 DDD patients. The analysis yielded evidence for five discrete subgroups: three of varying severity levels and two moderate-to-severe classes characterized by differential dissociative symptoms. The five classes reliably differed on several non-dissociative symptoms, comorbidities, and factors precipitating their diagnosis but did not significantly differ in other symptoms including anxiety. These results suggest the presence of three distinct DDD subtypes in the upper severity range that are distinguished by differential expression of detachment and compartmentalization symptoms. Further elucidation of these subtypes has potential implications for the aetiology, mechanisms, and treatment of DDD.

3.2 Introduction

DDD is characterized by heterogeneity comprising diverse symptomatology that overlaps with both anxiety and other dissociative disorders. DDD patients frequently experience cognitive symptoms of increased arousal paired with subjective deficits in attention and concentration, as seen in anxiety disorders (Wells & Matthews, 1994; see also Hunter, Phillips, Chalder, Sierra & David, 2003; Hunter, Salkovskis & David, 2014). Case series conducted by Simeon, Knutelska, Nelson and Guralnik (2003), Baker et al. (2003), and Michal et al. (2016), report high levels of comorbid anxiety in people with DDD.

Moreover, DDD differs from other dissociative disorders, with disturbances of memory observed less frequently (e.g., Lyssenko et al., 2018). Hunter et al. (2003) further proposed that DDD is most frequently triggered by one's response to situations that provoke anxiety (Hunter et al., 2003). This symptom overlap, and the high comorbidity of DDD with anxiety disorders (Sierra, Medford, Wyatt & David, 2012), implies an intrinsic link between DDD and anxiety.

A recent meta-analysis of dissociative symptoms in 19 psychiatric disorders (Lyssenko et al., 2018) leads to questions about the categorization of DDD as a dissociative disorder. In particular, general dissociative symptoms, as indexed by mean *Dissociative Experiences Scale* (DES; Carlson and Putnam, 1993) scores, were lower in patients with DDD than those diagnosed with functional neurological disorder, borderline personality disorder, PTSD, dissociative identity disorder and other dissociative disorders (as defined by the "DSM-5 main category," p. 39). This suggests that the symptom profile of DDD does not reliably encompass the full spectrum of dissociative symptoms (Lyssenko et al., 2018). Factor analyses of the *Cambridge Depersonalization Scale* (CDS; Sierra and Berrios, 2000) and the DES-II (Carlson and Putnam, 1993) similarly point to symptom clusters including amnesia, absorption and imaginative involvement, emotional numbing and alienation from surroundings that are only weakly to moderately related to one another (Sierra, Baker, Medford, & David, 2005; Carlson et al., 1991). These variable symptom profiles are perhaps encapsulated in the distinction between *detachment* and *compartmentalization* symptoms (Holmes et al., 2005; Brown, 2006), where the authors highlight that although 'dissociation' is often used as if a unitary phenomenon, there are distinct and qualitatively different types within this broad definition and a clearer terminology will aid both research and treatment. They propose that 'detachment' is defined by a subjective sense of separation as typified by experiences of depersonalization and derealization, whereas 'compartmentalization' refers to a dissociative inability to have deliberate control over actions or processes and includes dissociative amnesia, fugue, and functional neurological symptoms (e.g., nonepileptic seizures) (Brown, 2006; Holmes et al., 2005). In this way, the use of the overall mean DES score combines qualitatively different types of dissociation and can reduce clarity of diagnosis. Lower DES scores in DDD (Lyssenko et al., 2018) thus are plausibly attributed to fewer ‘compartmentalization’ symptoms in this population than in other dissociative disorders and germane conditions.

A more refined understanding of variable symptomatology within DDD may be developed by evaluating the extent to which this patient population is comprised of discrete subgroups of individuals with differing levels of anxiety, detachment, and compartmentalization symptoms. One way to achieve this is through the use of latent profile analysis (LPA). LPA stemmed from latent class analysis (LCA), originally designed for use with discrete variables (Ferguson, Moore, & Hull, 2019; Nylund-Gibson & Choi, 2018; Masyn, 2013) and is a form of LCA that evaluates continuous observed scores and determines a set of nonoverlapping subgroups or classes of individuals based on their scores on a set of indicator variables (Tein, Coxe, & Cham, 2013; Wolf et al., 2012). LPA assumes that within a broader population: 1) individual differences are present, 2) the differences that are seen occur in a systematic way, and 3) the profiles that are uncovered are meaningful (Ferguson, Moore, & Hull, 2019). This type of analysis “provides the opportunity to examine these profiles and what predicts or is predicted by membership within the different profiles” (Ferguson, Moore, & Hull, 2019, p. 6). LPA is a particularly useful technique within populations that present heterogeneous characteristics or symptomatology (Tein, Coxe, & Cham, 2013), as is the case with DDD. For example, typological analytic approaches to heterogeneity within PTSD has reliably yielded evidence for a dissociative subtype (Lanius et al., 2010; Steuwe, Lanius, & Frewen, 2012; Lanius, Brand, Vermetten, Frewen, & Spiegel, 2012; Wolf et al., 2012; Blevins, Weathers, & Witte, 2014), that is now recognized in the DSM-5 (American Psychiatric Association, 2013). This subgroup is characterized by higher levels of depersonalization and derealization symptoms, an increased likelihood of comorbid Axis I disorders, and more reports of childhood abuse and neglect (Wolf et al., 2012; Steuwe, Lanius, & Frewen, 2012) with clinical implications for long-term prognosis and treatment. Applying this analytic orientation of LPA to DDD may plausibly lend similar insights, which have been highly valuable in the case of PTSD, into variability in the expression of this condition and inform understanding of differential etiologies and responsiveness to different treatment regimens in DDD subgroups.

The aim of this paper was to better characterize the heterogeneous symptomatology of DDD by evaluating the extent to which this condition includes discrete, meaningful, subgroups of individuals that may experience varying levels of detachment, compartmentalization, and anxiety symptoms. Toward this end, we applied latent profile analysis (LPA), a latent variable modeling technique for partitioning multivariate data into latent classes (McCutcheon, 1987; Vermunt & Magidson, 2002), to the anxiety and dissociative symptom profiles of DDD patients. Based on the research describing two qualitatively different types of dissociation, *compartmentalization* and *detachment* (Holmes et al., 2005; Brown, 2006), which encompass different categories of symptoms, as well as the overlap between anxiety and DDD seen with the high levels of comorbid anxiety in this population (Simeon, Knutelska, Nelson, & Guralnik, 2003; Baker et al., 2003; Michal et al., 2016) and similar cognitive symptoms and subjective deficits (Wells & Matthews, 1994; Hunter, Salkovskis & David, 2014), we expected to identify at least three or more distinct latent classes characterized by differentially elevated anxiety, detachment, or compartmentalization symptoms. These latent classes may then be more or less aligned with other dissociative disorders, exhibiting elevated compartmentalization symptoms, or anxiety disorders, exhibiting more severe anxiety, with potential implications for directing tailored treatment.

3.3 Materials & Methods

3.3.1 Participants

The data were obtained from a database of patients with DDD collected during the years 1999-2019 (*N*=658) in the Depersonalization Research Unit at the Institute of Psychiatry, Psychology and Neuroscience, King’s College London (Baker et al., 2003; Sierra et al., 2012). Patients in this cohort of consecutive eligible cases were referred to the research unit for diagnostic purposes (initial cases) or were seen in an NHS (National Health Service) clinic for DDD (later cases) or contacted the research unit expressing an interest in participating in research on DDD. For those not seen in person, a telephone assessment including the Present State Examination depersonalization/derealization items was conducted to determine diagnostic status.

After removing (patient) controls (*n*=48) and repeat patients who attended the clinic at two separate time points (*n*=23), this sample was comprised of 587 patients. For inclusion in the present analyses, DDD patients had to meet one of the following diagnostic criteria: *Present State Examination* (PSE; Wing et al., 1967) score ≥2 on the depersonalization/derealization items ("Over the last two weeks, how often have you been bothered by the presence of: a) Your surroundings feeling detached or unreal, as if there were a veil between you and the outside world [*derealization*]; b) Out of the blue, you feel strange, as if you were not real or as if you were cut off from the world" [*depersonalization*]; scored from 0 [not at all] to 3 [nearly every day] for both items); DSM diagnosis of DDD (DSM-IV, 1994; DSM-5, 2013); or DDD diagnosis confirmed by a specialist psychiatric clinician following a 1-2 hour clinical interview including the PSE depersonalization/derealization criteria, with any differential diagnoses made during this clinical assessment. Applying these inclusion criteria left *N*=335 patients. Additional exclusion criteria included: missing data for more than 5 of the 29 questions on the *Cambridge Depersonalization Scale* (CDS; Sierra and Berrios, 2000) and/or for more than 3 of the 9 indicator variables in the Latent Profile Analysis (LPA; see below), resulting in a final sample of 303 patients. Participants were not excluded based on any demographic variables including age, gender, marital status, or work status, to ensure that our sample was as large and as representative as possible of the individuals who were given a clinical DDD diagnosis and/or treatment from the Depersonalisation Research Unit across this period. Data were collected as part of a clinical audit and all patients provided written informed consent for their data to be used for research purposes.

3.3.2 Measures

Medical and Psychiatric History Questionnaire

A detailed questionnaire was designed by the research team for the purposes of audit (Baker et al, 2003). This asked participants to give information about their personal history and history of DDD including questions about potential triggers for onset, pattern of onset, course of their DDD and fluctuations in severity, as well as other psychiatric symptoms and diagnoses and medical conditions.

Beck Anxiety Inventory (BAI)

The BAI is a 21-item self-report anxiety measure (Beck et al., 1988). Respondents rate how much they have been bothered by specific symptoms in the past week using a 4-point Likert scale (0 [not at all] to 3 [severely]). Scores range from 0-63, with higher scores reflecting more severe anxiety (0-7 = minimal; 8-15 = mild; 16-25 = moderate; 26-63 = severe; Carney et al., 2011). The scale displayed good internal consistency (Cronbach's α = .92).

Cambridge Depersonalization Scale (CDS)

The CDS (Sierra and Berrios, 2000) is a 29-item self-administered questionnaire measuring trait depersonalization and derealization. Respondents rate the frequency (0-4) and duration (0-6) of different experiences in the preceding six months. Frequency and duration scores are summed across all items (0-10) with CDS total scores ranging from 0-290. The cut-off score associated with a clinical diagnosis of DDD in 80% of cases is 70 (Sierra and Berrios, 2000). Scores were also calculated for four subscales: emotional numbing (6 items; α = .85), anomalous body experience (9 items; α = .87), anomalous subjective recall (5 items; α = .73), and alienation from surroundings (4 items; α = .75) (Sierra et al., 2005).

Cambridge Depersonalization Scale – State Scale (CDS)

A state DDD scale was also developed by Sierra and Berrios (Baker, Hunter, Lawrence & David, 2007). This scale consists of 22 items of Depersonalization and Derealization to which participants rate the percentage severity experienced 'right now' on a visual analogue scale (0% to 100%). Scores are summed to calculate an overall percentage mean. The scale displayed good internal consistency (Cronbach's $\alpha = .93$).

Dissociative Experiences Scale (DES)

The DES-II (Carlson and Putnam, 1993) is a 28-item self-report measure of dissociative experiences using an 11-point scale (0% [never] to 100% [always]). Mean scores above 30 indicate severe levels of dissociation (Carlson et al., 1993). Mean scores were calculated for three subscales: depersonalization-derealization (6 items; $\alpha = .71$), amnesia (8 items; $\alpha = .82$), and absorption and imaginative involvement (9 items; $\alpha = .78$) (Carlson et al., 1991).

3.3.3 Statistical Analyses

Data Pre-Processing

Data were approximately normally distributed except the CDS 'alienation from surroundings' and DES 'amnesia' subscales, which displayed distribution normality after a log transformation. Missing data for the 9 indicator variables included in the LPA (BAI, four CDS subscales, three DES subscales, and CDS state) were found for 0.3%-6.6% of cases. Little's MCAR test was non-significant, $\chi^2(64) = 66.40$, $p = .39$, and therefore we assume the data were missing at random. Expectation-maximisation was used to estimate missing data for these 9 variables.

Latent Profile Analysis

The LPA was conducted on the 303 cases using Mplus Version 7.3 (Muthén and Muthén, 1998-2012) using nine indicator variables (BAI, four CDS subscales, three DES subscales, and CDS state). To determine the optimal number of classes, solutions were examined beginning with a 2-class solution until adding more classes was no longer justified. Class adjudication was performed with the Akaike information criterion (AIC; Akaike, 1973), the Bayesian information criterion (BIC; Schwarz, 1978), and the sample size-adjusted Bayesian information criterion (SSABIC; Sclove, 1987), for which lower values reflect superior fit, and the Bootstrap Likelihood Ratio Test (BLRT; McLachlan and Peel, 2000), for which a significant value indicates superior fit relative to the *k*-1 model. Previous research has shown that the BIC and BLRT are the best performing indices in class identification (Nylund et al., 2007) and thus these indices were prioritized. The BLRT appears to be more prone to class-overestimation than the BIC and thus the latter was selected *a priori* as the primary index for model selection. We also computed Entropy for each model, which provides a measure of the level of separation among the classes, and for which values > 0.80 indicate that the classes are highly discriminating from one another (Muthén & Muthén, 2007).

Inferential Statistics

After determining the optimal class solution in the LPA, we performed one-way between-groups ANOVAs to evaluate class differences on the 9 LPA indicator variables followed by *post hoc* Tukey HSD tests. The latent classes were subsequently compared using Pearson's chi-square tests examining the main effects of class on 21 other variables of interest comprising three categories: (1) *Symptoms* (panic attack, OCD persistent thoughts, hallucinations, fainting attacks, OCD compulsive behaviour, recurrent headaches/migraines); (2) *Precipitating factors* (substance related, psychological related, situational related, trauma related, social related, physical related; and (3) *Current comorbidities* (major depression, panic disorder, anxiety, OCD, agoraphobia, schizophrenia, drug abuse, alcohol abuse, bipolar disorder). All significant main effects were followed up with 2x2 chi-square tests. When the expected cell count was below 5, Fisher's exact tests were used. Eta squared, Hedges' *g*, and *phi* were computed as effect sizes measures for ANOVAs, Tukey tests, and chi-squared/Fisher's exact tests. These analyses were conducted using SPSS Version 23 (IBM Corp, 2015).

3.4 Results

3.4.1 Patient demographics

Patients were predominantly males (57.4%) and within the age range of 15-89 with an average age of 34.5 (SD = 12.44). 46.2% were single, 12.2% married, 3.9% with a partner, 2.6% separated/divorced, 1.7% widowed, 0.7% other, and 32.7% did not report their marital status. Current work status indicated 35% in employment, 17.2% unemployed, 8.9% students, 3.3% retired, and 35.6% did not report their current work status.

3.4.2 Latent profile analysis

Determination of number of latent classes

The best fitting model, as indicated by the BIC, was the five-class solution (see **Table 3.1** for model comparisons). This model had the lowest BIC and an entropy value that was stable with the four- and six- class solutions. Although the six-class solution had a lower AIC value, and a significant BLRT value, the BIC was lower for the five-class model and thus this model was selected as the optimal model.

Table 3.1 Fit indices for the LPA on anxiety, depersonalization-derealization and dissociative symptoms in DDD patients (N=303).

Model	AIC	BIC	SSABIC	BLRT	Entropy
2 classes	17685.45	17789.44	17700.63	915.50*	.90
3 classes	17483.05	17624.17	17503.66	222.40*	.86
4 classes	17398.65	17576.91	17424.68	104.40*	.84
5 classes	**17351.80**	**17567.19**	**17383.25**	**66.86***	**.84**
6 classes	17322.17	17574.70	17359.04	49.63*	.84

Notes. AIC = Akaike information criterion; BIC = Bayesian information criterion; SSABIC = sample size-adjusted BIC; BLRT = bootstrap likelihood ratio test. Optimal model in bold. * p<.001

Class Characteristics

The symptom profiles of the five classes are presented in **Figure 3.1**. Class 1 (26%; *Low severity*) was characterized by moderate anxiety but lower scores across all other measures whereas Class 2 (30%; *Moderate severity*) displayed a flat profile of moderate scores across scales. Class 3 (11%; *High dissociation*) was characterized by moderate CDS subscale scores, but high DES scores whereas Class 4 (22%; *High depersonalization*) displayed the converse pattern: higher CDS subscale scores but more moderate DES subscale scores. Finally, Class 5 (12%; *High severity*) was characterized by high scores across measures. Overall, there is some variability in anxiety scores (BAI), but this variable did not discriminate among the classes very well.

Although the participant age range was large (15-89, **Table 3.2**), participant groups did not reliably differ from each other on this or any other demographic variables, though there was a suggestive tendency for the Low severity and High severity classes to report the oldest and youngest ages of symptom onset, respectively. Sample counts and proportions of patients in each class according to symptom severity, as well as bivariate correlations among the nine LPA variables, are presented in the Appendix (**Table A1, Table A2**). 43% of patients in the High severity class met criteria for severe anxiety whereas only ~25% of patients in the remaining classes met this criterion. Eighty percent or more of patients scored above 70 on the CDS in all classes except the Low severity class. Finally, 90% or more of patients in the High dissociation and High severity classes displayed severe dissociation; by contrast, just over 50% of patients in the High depersonalization class, and fewer than 10% in the Low and Moderate severity classes met this criterion. Cumulatively, these results suggest that the High dissociation and High severity classes specifically experienced the most severe dissociation, as measured by the DES. Further, the High depersonalization and High severity classes were the only two classes to have all members scoring above 70 on the CDS, exhibiting the highest depersonalization-specific scores, with the High severity class additionally experiencing the most severe anxiety.

Table 3.2 Demographic information as a function of latent class.

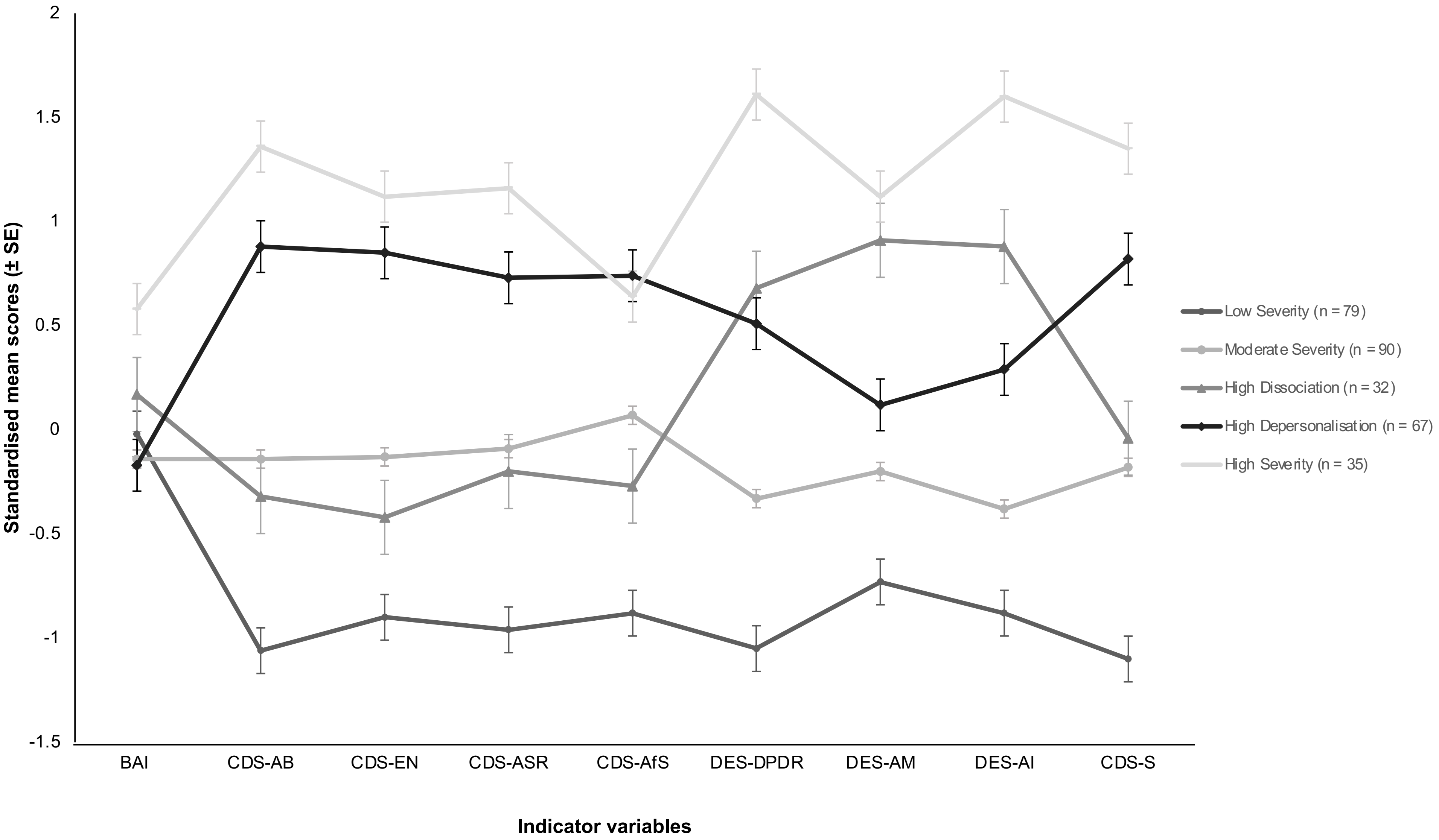
Variable	Low Severity (*n* = 79) *M* (*SD*) [*n*]	Moderate Severity (*n* = 90) *M* (*SD*) [*n*]	High Dissociation (*n* = 32) *M* (*SD*) [*n*]	High Depersonalization (*n* = 67) *M* (*SD*) [*n*]	High Severity (*n* = 35) *M* (*SD*) [*n*]	*F* (df)	*p*	*η2*
Age	37.03 (12.57) 78	34.10 (12.63) 90	33.86 (13.07) 29	33.34 (12.29) 64	32.89 (11.26) 35	1.133 (4, 295)	.34	015
Age of onset	24.41 (12.41) 74	20.66 (8.88) 82	21.05 (9.95) 29	20.84 (8.74) 55	18.41 (8.87) 27	2.398 (4, 266)	.051	.035
	% (n)* *[n]	***% (n)* *[n]***	***% (n)* *[n]***	***% (n)* *[n]***	***% (n)* *[n]***	***χ2 (N)***	***p***	***Φ***
Gender (% male)	59% (47) [79]	56% (50) [90]	56% (18) [32]	55% (36) [65]	66% (23) [35]	4.293 (174)	.802	.12
Education (% university)	57% (39) [69]	62% (51) [82]	59% (16) [27]	54% (29) [54]	69% (18) [26]	12.71 (153)	.544	.22
Relationship status (% single)	63% (35) [56]	68% (47) [69]	67% (10) [15]	70% (28) [40]	83% (20) [24]	26.71 (140)	.197	.36

3.4.3 Class characteristics across LPA indicator variables

BAI

There was a significant main effect of Class on BAI scores (see **Table 3.3**). The High severity class displayed significantly higher scores than both the Moderate severity (p = .002, g = .68) and the High depersonalization (p = .002, g = .78) classes, with a trend towards higher scores than the Low severity class (p = .022, g = .59). There were no other significant class differences (all *p*s > .40, all *g*s < .41). These results suggest that the classes were relatively comparable except the High severity class, which was characterized by elevated BAI scores.

Figure 3.1 Standardized mean scores on the 9 indicator variables included in the LPA as a function of latent class.



Notes. BAI = *Beck Anxiety Inventory*; CDS = *Cambridge Depersonalization Scale*; DES = *Dissociative Experiences Scale*; CDS-AB = CDS *anomalous bodily experiences*; CDS-EN = CDS *emotional numbing*; CDS-ASR = CDS *anomalous subjective recall*; CDS-AfS = CDS *alienation from surroundings*; DES-DPDR = DES *depersonalization-derealization*; DES-AM = DES *amnesia*; DES-AI = DES *absorption and imaginative involvement*; CDS-S = CDS *state*. Scores were standardized to allow for comparison among indicator variables.

CDS

There were significant main effects of Class on all CDS subscales. All classes significantly differed on the AB subscale with large, albeit variable, effect sizes (*p*s < .001, *g* range: 0.78 – 4.77) except the Moderate severity and High dissociation classes (*p* = .48, *g* = 0.33). All classes significantly differed on the EN subscale with large effects (*p*s < .01, *g* range 0.80 – 3.24) except the Moderate severity and High dissociation classes (*p* = .23, *g* = 0.43) as well as the High depersonalization and High severity classes (*p* = .34, *g* = 0.35). All classes significantly differed on the ASR subscale with large effects (*p*s < .001, *g* range: 1.10 – 3.73) except the Moderate severity and the High dissociation classes (*p* = .93, *g* = 0.16) although there was a borderline nonsignificant difference between the High depersonalization and the High severity classes (*p* = .03, *g* = 0.53). All classes significantly differed on the AfS subscale with moderate to large effects (*p*s < .005, *g* range: 0.58 – 2.06) except the Moderate severity and the High dissociation classes (*p* = .24, *g* = 0.37) as well as the High depersonalization and the High severity classes (*p* = .97, *g* = 0.33). All classes significantly differed on the CDS-S with large effects (*p*s < .001, *g* range: 1.35 – 4.78) except the Moderate severity and the High dissociation classes (*p* = .72, *g* = 0.23). These results suggest that the classes exhibited considerable differences in depersonalization-derealization symptoms with the High severity class exhibiting the highest anomalous bodily experience, emotional numbing and anomalous subjective recall subscale scores, and the High depersonalization class characterized by elevated alienation from surroundings scores. Further, the High depersonalization class exhibited significantly higher scores on all CDS subscales as well as the state CDS than the High dissociation class, indicating more severe broad depersonalization symptoms.

Table 3.3 Anxiety, depersonalization and dissociation symptoms [*M* and (*SD*)] in DDD patients as a function of latent class.

Variable	Low Severity (*n* = 79)	Moderate Severity (*n* = 90)	High Dissociation (*n* = 32)	High Depersonalization (*n* = 67)	High Severity (*n* = 35)	*F* (4, 298)	*p*	*η2*
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)			
BAI	19.99 (11.46)	18.55 $(12.53)^{a}$	22.21 (10.08)	18.19 $(10.44)^{b}$	27.21 $(13.60)^{a,b}$	4.32	.002	.06
CDS-AB	13.74 $(10.13)^{a,b,c,d}$	34.62 $(13.24)^{a,c,d}$	30.41 $(10.90)^{b,c,d}$	57.57 $(13.96)^{c,d}$	68.51 $(14.13)^{d}$	170.83	<.001	.70
CDS-EN	9.89 $(9.73)^{a,b,c,d}$	23.06 $(11.51)^{a,c,d}$	18.13 $(11.58)^{b,c,d}$	39.63 $(13.04)^{c}$	44.11 $(12.27)^{d}$	88.30	<.001	.54
CDS-ASR	8.19 $(5.92)^{a,b,c,d}$	18.56 $(8.55)^{a,c,d}$	17.19 $(8.39)^{b,c,d}$	28.28 $(10.01)^{c}$	33.37 $(8.35)^{d}$	81.26	<.001	.52
CDS-AfS	1.27 $(.19)^{a,b,c,d}$	1.44 $(.15)^{a,c,d}$	1.38 $(.19)^{b,c,d}$	1.57 $(.06)^{c}$	1.55 $(.06)^{d}$	45.91	<.001	.38
DES-DPDR	13.41 $(9.62)^{a,b,c,d}$	28.68 $(10.99)^{a,b,c,d}$	49.84 $(11.57)^{b,d}$	46.24 $(11.81)^{c,d}$	69.24 $(11.74)^{d}$	200.51	<.001	.73
DES-AM	.38 $(.39)^{a,b,c,d}$	.66 $(.41)^{a,b,d}$	1.25 $(.24)^{b,c}$	.83 $(.48)^{c,d}$	1.36 $(.45)^{d}$	47.64	<.001	.39
DES-AI	13.99 $(9.30)^{a,b,c,d}$	22.67 $(10.31)^{a,b,c}$	44.99 $(11.55)^{b,c,d}$	34.67 $(11.44)^{c,d}$	57.84 $(11.85)^{d}$	134.19	<.001	.64
CDS-S	19.58 $(11.54)^{a,b,c,d}$	38.83 $(13.00)^{a,c,d}$	42.07 $(17.28)^{b,c,d}$	60.73 $(11.90)^{c,d}$	72.22 $(9.68)^{d}$	151.29	<.001	.67

Notes. BAI = *Beck Anxiety Inventory*; CDS = *Cambridge Depersonalization Scale*; DES = *Dissociative Experiences Scale*; CDS-AB = CDS *anomalous body experience*; CDS-EN = CDS *emotional numbing*; CDS-ASR = CDS *anomalous subjective recall*; CDS-AfS = CDS *alienation from surroundings*; DES-DPDR = DES *depersonalization-derealization*; DES-AM = DES *amnesia*; DES-AI = DES *absorption and imaginative involvement*; CDS-S = CDS *state*. Superscripted letters indicate significant differences (*p*<.05) between classes marked with paired letters according to Tukey's HSD test.

DES

There were also significant main effects of Class on all DES subscales. All classes significantly differed on the DPDR subscale with large effects (*p*s < .001, *g* range: 1.47-5.42) except the High dissociation and High depersonalization classes (*p* = .55, *g* = 0.31). All classes significantly differed on the AM subscale with moderate to large effects (*p*s < .001, *g* range: 0.70 – 2.46) except the High dissociation and High severity classes (*p* = .81, *g* = 0.30). All classes significantly differed on the AI subscale with large effects (*p*s < .001, *g* range: 0.88 – 4.32). Overall, these results suggest that the classes were markedly different from each other with the High severity class exhibiting the highest levels of dissociation across subscales, and the High dissociation class characterized by elevated amnesia and absorption and imaginative involvement subscale scores. This is particularly interesting in relation to the High depersonalization class, which did not significantly differ in depersonalization from the High dissociation class even though the latter displayed more severe dissociative amnesia and absorption scores. This suggests that the High dissociation class experiences a higher severity of broad compartmentalization symptoms, as compared to the High depersonalization class.

3.4.4 Differences across symptoms, precipitating factors and comorbid diagnoses

Symptoms

The classes were compared on six non-dissociative symptoms (**Table 3.4**). There was a main effect of Class on panic attacks with the High dissociation class reporting significantly more attacks than the High depersonalization ($p < .001$, *phi* = .36), Low Severity ($p = .003$, *phi* = .29) and Moderate severity ($p = .006$, *phi* = .26) classes. There were no other significant class differences (all *p*s > .14). There was a main effect of Class on hallucinations, with both the High severity class and the High depersonalization class reporting significantly more hallucinations than the Low severity class ($p < .001$, *phi* = .34; $p = .020$, *phi* = .21, respectively). No other significant class differences were observed (all *p*s > .24). There was a main effect of Class on OCD compulsive behaviour, with the High severity class reporting significantly more OCD compulsive behaviour than the High dissociation ($p = .006$, *phi* = .38), Low Severity ($p = .015$, *phi* = .25), and Moderate severity classes ($p = .027$, *phi* = .22). There were no other significant Class differences (all *p*s > .20). There were no significant effects for the other symptoms, with corresponding low effect sizes. These results are broadly consistent with the most severe class (High severity) being characterized by a propensity for other psychiatric symptoms including hallucinations and compulsive behaviour but with panic attacks being the most prevalent for those in the High dissociation class.

Table 3.4 Non-dissociative symptoms, precipitating factors, and comorbidities as a function of latent class.

Symptoms	*Low Severity* % (n) [n]	*Moderate Severity* % (n) [n]	*High Dissociation* % (n) [n]	*High Depersonalization* % (n) [n]	*High Severity* % (n) [n]	*N*	$\chi 2$	*P*	*Φ*
Panic attacks	65% (46) [c] [71]	68% (54) [b] [79]	93% (28) [a,b,c] [30]	59% (32) [a,d] [54]	80% (20) [d] [25]	180	2.80	.012*	.22
OCD persistent thoughts	65% (45) [69]	72% (58) [81]	83% (24) [29]	68% (36) [53]	85% (23) [27]	186	.98	.20	.15
Hallucinations	9% (6) [a,b] [67]	19% (15) [79]	23% (7) [30]	25% (13) [b] [53]	37% (10) [a] [27]	51	10.98	.027*	.21
Fainting attacks	19% (13) [68]	19% (15) [78]	27% (8) [30]	15% (8) [53]	33% (9) [27]	53	4.50	.34	.13
OCD compulsive behaviour	24% (16) [b] [67]	27% (21) [c] [79]	15% (4) [a] [27]	35% (17) [49]	50% (13) [a,b,c] [26]	71	10.12	.039*	.20
Recurrent headaches	24% (15) [62]	35% (27) [77]	44% (12) [27]	44% (23) [52]	39% (9) [23]	86	6.26	.18	.16
Precipitating factors									
Substance-related factors	14% (7) [a,b] [50]	40% (27) [a] [68]	31% (5) [16]	33% (12) [b] [36]	18% (3) [17]	54	0.71	.030*	.24
Psychological factors	43% (20) [46]	39% (25) [64]	25% (4) [16]	51% (18) [35]	47% (8) [17]	75	3.62	.46	.14
Situational factors	20% (10) [49]	18% (12) [67]	13% (2) [16]	31% (11) [35]	24% (4) [17]	39	3.43	.49	.14
Traumatic factors	16% (8) [50]	17% (11) [66]	19% (3) [16]	26% (9) [35]	24% (4) [17]	35	1.78	.78	.10
Social factors	14% (7) [a] [49]	14% (9) [b,c] [66]	19% (3) [16]	40% (14) [a,b] [35]	35% (6) [c] [17]	39	13.10	.011*	.27
Physical factors	20% (10) [49]	15% (10) [66]	19% (3) [16]	12% (4) [34]	6% (1) [17]	28	2.61	.62	.12
Current comorbidities									
Major depression	31% (19) [61]	43% 33 [77]	39% (9) [23]	33% (16) [48]	44% (12) [27]	89	2.92	.57	.11
Panic disorder	1% (3) [60]	12% (8) [69]	18% (4) [22]	11% (5) [46]	19% (5) [26]	25	5.10	.28	.15
Anxiety	37% (22) [60]	44% (31) [70]	43% (9) [21]	28% (13) [47]	35% (9) [26]	84	3.68	.45	.13
OCD	1% (3) [60]	10% (7) [71]	14% (3) [22]	10% (5) [48]	10% (2) [27]	20	2.05	.73	.10
Agoraphobia	3% (2) [60]	1% (1) [69]	5% (1) [22]	0% (0) [45]	12% (3) [26]	7	8.25	.08	.19
Schizophrenia	5% (3) [61]	1% (1) [a] [69]	0% (0) [22]	4% (2) [45]	15% (4) [a] [26]	10	9.76	.045*	.21
Drug abuse	0% (0) [60]	1% (1) [69]	0% (0) [22]	0% (0) [45]	0% (0) [26]	1	2.23	.69	.10
Alcohol abuse	0% (0) [60]	1% (1) [69]	0% (0) [22]	2% (1) [45]	0% (0) [26]	2	2.09	.72	.10
Bipolar disorder	2% (1) [60]	1% (1) [a] [69]	0% (2) [22]	11% (5) [a] [46]	0% (0) [26]	9	10.15	.038*	.21

Notes. Superscripted letters indicate significant differences between classes marked with paired letters. **p*<.05

Precipitating Factors

The classes were next compared on six variables corresponding to patients' subjective reports of the factors that precipitated their symptoms (**Table 3.4**). There was a main effect of Class on substance-related factors with significantly more patients in both the Moderate severity and the High depersonalization classes attributing their DDD symptoms to substance-related factors than those in the Low severity class (*p* = .002, *phi* = .28; *p* = .033, *phi* = .23, respectively). There were no other significant class differences (all *p*s > .11). There was a main effect of Class on social factors with significantly more patients in the High depersonalization class attributing their symptoms to social factors than those in the Low severity (p = .007, *phi* = .29) and Moderate severity (p = .003, *phi* = .30) classes. There were also significantly more patients in the High severity class attributing their symptoms to social factors than those in the Moderate severity class (p = .039, *phi* = .23). There were no other significant class differences (all *p*s > .14). There were no significant Class effects for the other factors, with corresponding low effect sizes. Overall, patients in the Moderate severity class were more likely to attribute their symptoms to substance-related factors whereas those in the High depersonalization class were more likely to attribute symptoms to social factors.

Comorbidities

Our final set of analyses examined whether the classes differed on nine current comorbid diagnoses (**Table 3.4**). There was a main effect of Class on comorbid schizophrenia with the High severity class exhibiting significantly more comorbid diagnoses than the Moderate severity class (p = .019, *phi* = .28). There were no other significant class differences (all *p*s > .11). There was also a main effect of Class on comorbid bipolar disorder with the High depersonalization class exhibiting significantly more comorbid diagnoses than the Moderate severity class (p = .037, *phi* = .21). There were no other significant class differences (all *p*s > .14). No other significant Class effects were observed for the other current comorbid diagnoses, with corresponding low effect sizes. Overall, the High severity class was the most likely to have a current comorbid diagnosis of schizophrenia whereas the High depersonalization class was the most likely to have a current comorbid diagnosis of bipolar disorder.

3.5 Discussion

This study used latent profile analysis (LPA) to assess the extent to which symptom heterogeneity in DDD can be understood to reflect the presence of discrete latent classes. The analyses yielded evidence for five distinct classes of DDD patients with three comprising subtypes based on severity (Low severity, Moderate severity, High severity), and two subtypes differing primarily on detachment and compartmentalization dissociative symptomatology (High depersonalization, High dissociation) (Brown, 2006; Holmes et al., 2005). Further analyses suggest that these classes display broader differences in non-dissociative symptoms. The results suggest that symptom heterogeneity in DDD is potentially attributable to discrete symptom subgroups with implications for the aetiology, mechanisms, and treatment of this condition.

Aside from different severity classes, the most notable distinction between classes were the divergent patterns of detachment and compartmentalization symptoms in the High dissociation and High depersonalization subtypes. The High depersonalization class exhibited uniformly higher scores on all CDS subscales (Sierra & Berrios, 2000) and the state CDS (Baker, Hunter, Lawrence, & David, 2007) relative to the High dissociation class, as well as the most severe scores on the alienation from surroundings CDS subscale (Sierra et al., 2005; Baker et al., 2007). The symptoms that were elevated in the High depersonalization class sit at the core of a DDD diagnosis where a feeling of detachment from one's mental states, body, or self, and a detachment and sense of unreality from one's surroundings, are characteristic symptoms of this condition (Hunter, Salkovskis, & David, 2014).

In contrast, the High dissociation class exhibited more severe amnesia symptoms as well as absorption and imaginative involvement experiences than the High depersonalization class. This suggests that the former class is perhaps better distinguished by the reporting of compartmentalization symptoms (Holmes et al., 2005; Brown, 2006). Compartmentalization symptoms involve a subjective inability to exercise deliberate control over particular processes or actions and may materialize as amnesia, behavioural or emotional dysregulations, fugue, and functional neurological symptoms (Spitzer, Barnow, Freyberger, & Grabe, 2006). Although commonly reported in other DSM-5 dissociative disorders, such as *dissociative amnesia* and *dissociative identity disorder* (Spiegel et al., 2013), they are not a core feature of DDD (American Psychiatric Association, 2013; Hunter et al., 2003). The only dissociative measure in which the High dissociation and High depersonalization classes did not significantly differ was the DES depersonalization-derealization subscale. Insofar as this subscale typically correlates strongly with the CDS (Sierra & Berrios, 2000), these results potentially reflect a context effect wherein depersonalization symptoms were rated in the context of other dissociative symptoms, thereby elevating this subscale score in the High dissociation class (Council, 1993).

Class differences become more pronounced when examining particular subscales of the CDS and DES. For example, the DES absorption and imaginative involvement subscale provided the clearest separation of the five classes and class severity. Dissociative absorption reflects the degree to which an individual can be immersed in or absorbed by an external stimulus or their own internal imagination (Carlson & Putnam, 1993; Soffer-Dudek, 2015; Soffer-Dudek, 2018; Schimmenti & Sar, 2019). A vivid imagination and inclination to become completely absorbed by a stimulus whilst ignoring the rest of one's environment can, in extreme contexts, lead to impaired reality monitoring (Soffer-Dudek, 2015). Elevated dissociative absorption potentially contributes to, or covaries with, broader symptom severity including feelings of automaticity and a loss of the sense of self or agency (Bregman-Hai, Kessler, & Soffer-Dudek, 2020) and the other non-dissociative symptoms and psychiatric comorbidities observed in the most severe DDD classes.

A notable finding was that anxiety was not a strong indicator of class differences within this sample. All five classes were relatively comparable in anxiety scores with the exception of the High severity class, which exhibited the most severe scores. These results are potentially at odds with research on the association between depersonalization-derealization and anxiety symptoms in DDD (Sierra et al., 2012). The apparent inconsistencies indicate that the relationship between depersonalization and anxiety is complex. Further research into this question will require a wider range of anxiety measures that better explore both different forms of anxiety including PTSD (Lanius et al., 2012), panic disorder (Segui, Ma'rquez, Garcia, Canet, Salvador-Carulla, & Ortiz, 2000) and OCD (Soffer-Dudek, 2018) and their specific symptoms. With the dissociative subtype of PTSD being primarily defined by the presence of depersonalization-derealization symptoms (Choi et al., 2017), further research would benefit from measuring PTSD symptoms including flashbacks and hypervigilance (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015), within DDD.

Class differences extended to multiple non-dissociative psychiatric symptoms. As expected, the most severe class (High severity) was characterized by a greater propensity for other psychiatric symptoms including OCD compulsive behaviour. Obsessive checking or monitoring of symptoms, which can precipitate compulsive behaviours, is frequent in DDD (Simeon & Hollander, 1993; Baker et al., 2003) and may reflect an attempt to cope with depersonalization-derealization symptoms. Beyond this, it has been suggested that absorption, as more strongly reported by the High severity class, could be a risk factor for developing obsessive-compulsive behaviour or symptoms (Soffer-Dudek, 2018). Hallucinations were most common in the High severity and High depersonalization classes. This aligns with research demonstrating that depersonalization, anxiety, and absorption are reliable predictors of hallucination-proneness (Perona-Garcelan et al., 2012; Baker et al., 2003; Sierra et al., 2012) and independent work documenting robust associations between dissociative symptoms and hallucinations (Pilton, Varese, Berry, & Bucci, 2015). Finally, panic attacks were most commonly reported in the High dissociation class. This corroborates previous research documenting associations between panic attacks and dissociative symptoms (Segui et al., 2000; Baker et al., 2003; Hunter et al., 2003; Sierra et al., 2012) and a high prevalence of symptoms of depersonalization and the disorder itself in patients diagnosed with panic disorder (Mendoza et al., 2011).

Another route for interpreting these different subtypes is the experience of comorbid psychiatric disorders. The High severity class exhibited an increased rate of comorbid schizophrenia, which aligns with their increased reporting of hallucinations (Perona-Garcelan et al., 2012; Varese, Barkus, & Bentall, 2012; Longden et al., 2020) and with the high frequency of dissociative symptoms in schizophrenia (O'Driscoll, Laing, & Mason, 2014). There is also a documented relationship between dissociation and a history of trauma in schizophrenia spectrum disorders (Renard et al., 2017) wherein patients with PTSD and schizophrenia with a history of trauma exhibited significantly higher dissociative symptoms as compared to schizophrenic patients with no trauma history (Wearne et al., 2020). The High depersonalization class was characterized by a higher rate of comorbid bipolar disorder. This is in line with research indicating a high prevalence of comorbid depression in DDD patients (Baker et al., 2003; Michal et al., 2016), the presence of lifetime dissociative symptoms in individuals with bipolar disorder (Mula et al., 2009) and an association between the severity of dissociation and self-reported trauma history in both patients with bipolar disorder (Tuineag et al., 2020) and borderline personality disorder (Sar, Alioglu, & Akyuz, 2017).

Beyond symptoms and comorbidities, a further interpretation of these latent classes is that the differential expression of DDD arises from different antecedent factors. Analyses of patient's subjective reports of factors that precipitated their DDD symptoms revealed that patients in the Moderate severity class mostly attributed their symptoms to substance-related factors whereas those in the High depersonalization and High severity classes tended more to attribute their symptoms to social factors. Previous research suggests that DDD can be triggered by a range of factors including, but not limited to, a traumatic event, severe stress, panic, and consumption of drugs including marijuana or hallucinogens (Hunter, Charlton, & David, 2017). However, self-reported precipitating factors were not particularly robust discriminators among the five classes. Although these subjective appraisals should be interpreted with caution, they can lend insights into patients' *perceptions* of their symptoms, which may play an important role in their management and experience of the disorder (Petrie & Weinman, 2012) and could be an important target for treatment.

Despite the advances afforded by the present analyses, they need to be considered in the context of multiple limitations. Although we included three measures with eight sub-factors of dissociation and depersonalization, only one indicator of anxiety was included in the analysis, which plausibly reduced the influence of anxiety symptoms in the demarcation of DDD classes. Future research will need to achieve greater balance in the relative assessment of anxiety and other symptoms in order to more robustly assess the possibility of a subtype of DDD characterized by high anxiety and low depersonalization-derealization (Sierra et al., 2012). A further limitation is missing data. Any variables with missing data for more than half of the patients were automatically excluded from our analyses. Therefore, some important discriminating variables including other non-dissociative symptoms and comorbidities may have been excluded. A further limitation of the study is that we did not formally assess the presence of other dissociative disorders, such as dissociative amnesia. The symptomatology of certain DDD classes (e.g., High dissociation and High severity) may have high overlap with other dissociative disorders, and dissociative disorder comorbidities should be considered in further research on symptom heterogeneity in DDD. Lastly, all measures included in this analysis were self-report including previous diagnoses which were not verified. Future attempts to segregate these different subtypes will benefit from the use of neurophysiological measures as well as cognitive-perceptual measures such as interoceptive awareness or accuracy (Schandry, 1981) and time perception (Wearden, 1991).

The identification of these discrete subtypes of DDD characterized by dissimilar profiles of dissociative symptomatology may have implications for treatment. The relatively high levels of psychiatric symptoms and co-morbidity in the sample indicate the need for careful and thorough clinical assessments leading to individualized treatment formulations. These formulations should incorporate the role that specific psychiatric symptoms and co-morbidities might play in the onset and maintenance of the DDD, requiring an integrated approach to treatment (Hunter, 2013). The High severity class, encompassing approximately 10% of DDD patients, would require a more multidisciplinary plan with experienced practitioners that covers a broader and more severe symptom profile than those in the Low severity class. The High depersonalization and High dissociation classes may respond differently to the same treatment and therefore are likely to require more specific and tailored forms of treatment. Individuals in the High dissociation class may find more benefit from CBT or psychotherapy targeting symptoms of amnesia and absorption and attachment, while those in the High depersonalization class may benefit from specific CBT treatments (e.g., Hunter et al., 2005) focused on alleviating feelings of disembodiment and detachment, plus techniques such as grounding exercises and mindfulness (Nestler et al., 2015).

3.6 Conclusions

This analysis identified three DDD subtypes reflecting differential general severity levels, as would be expected and as previously observed in symptom fractionation analyses of other psychiatric conditions (Lanius et al., 2012; Au, Martinez de Andino, Mekawi, Silverstein, & Lamis, 2020). Beyond this, we identified a split between dissociative symptoms (amnesia, absorption) and broader depersonalization symptoms in DDD that aligns with the two qualitatively different categories of dissociative symptoms: *compartmentalization* and *detachment* (Brown, 2006). Within the DDD diagnosis, there emerges a subgroup that selectively experiences heightened detachment symptoms, central to DDD, and another subgroup that experiences increased compartmentalization symptoms often seen in other dissociative disorders (Spitzer et al., 2006). Although these analyses suggest that symptom heterogeneity in DDD is partially explained by latent classes, further research is needed to better examine measures of anxiety within this population and assess the replicability of these symptom subtypes. Beyond the two categories of dissociative symptoms that we have seen emerge in these subgroups, another classic feature of dissociative disorders more broadly is suggestibility, or the capacity to respond to direct verbal suggestions. Previous evidence has found suggestibility to be selectively elevated in dissociative psychopathology (Wieder et al., 2022) compared to anxiety disorders (Spinhoven et al., 1991) or schizophrenia (Frischholz et al., 1992), for example. This heightened suggestibility is perhaps due to the increased levels of compartmentalization symptoms seen in dissociative disorder populations including dissociative amnesia, dissociative identity disorder, and even trauma and stressor-related disorders (Holmes et al., 2005; Brown, 2006; Wieder et al., 2022). Levels of suggestibility have yet to be explored specifically in DDD and may be an interesting route to gain a better understanding of where DDD fits within dissociative disorders psychopathology, particularly in relation to symptoms of compartmentalization and detachment. The presence or absence of elevated verbal suggestibility in DDD will be explored in the next Chapter.

4. Assessing responsiveness to direct verbal suggestions in depersonalization-derealization disorder

4.1 Abstract

The dissociative disorders and germane conditions are reliably characterized by elevated responsiveness to direct verbal suggestions. However, it remains unclear whether atypical responsiveness to suggestion is similarly present in depersonalization-derealization disorder (DDD). 55 individuals with DDD and 36 healthy controls completed a standardized behavioural measure of direct verbal suggestibility that includes a correction for compliant responding (BSS-C), and psychometric measures of depersonalization-derealization (CDS), mindfulness (FFMQ), imagery vividness (VVIQ), and anxiety (GAD-7). Relative to controls, the DDD group did not exhibit elevated suggestibility (g = 0.26, BF_{10} = .11) but displayed significantly lower mindfulness (g = 1.38), and imagery vividness (g = 0.63), and significantly greater anxiety (g = 1.39). Although suggestibility did not correlate with severity of depersonalization-derealization symptoms in controls, r=-.03 [95% CI: -.36, .30], there was a weak tendency for a positive association in the DDD group, r=.25, [95% CI: -.03, .48]. Exploratory analyses revealed that those DDD individuals with more severe anomalous bodily experiences were also more responsive to suggestion, an effect not seen in controls. This study demonstrates that DDD is not characterized by elevated responsiveness to direct verbal suggestions. These results have implications for the aetiology and treatment of this condition, as well as its classification as a dissociative disorder in psychiatric nosology.

4.2 Introduction

The capacity to respond to direct verbal suggestions (suggestibility) provides a potential route to further elucidate how DDD fits within the dissociative disorders taxonomy. Hypnotic suggestibility, which is characterized by pronounced distortions in the sense of agency (Lush et al., 2017; Polito et al., 2014), and dissociation are historically intertwined (Ellenberger, 1970; Janet, 1889; Putnam, 1989) and have long been theorized to have overlapping mechanisms (Butler et al., 1996; Hilgard, 1986; Woody & Sadler, 2008). A recent meta-analysis (Wieder et al., 2022) found moderate-to-large effect sizes of elevated hypnotic suggestibility relative to controls in dissociative identity disorder and mixed dissociative disorders, and two germane conditions (trauma and stressor-related disorders and functional neurological disorder) (see also Bell et al., 2011; Dell, 2017; Terhune & Cardeña, 2015). Moreover, the available evidence suggests that elevated suggestibility is selective to dissociative psychopathology as it is not observed in anxiety disorders (Spinhoven et al., 1991) or schizophrenia (Frischholz et al., 1992; Pettinati et al., 1990). If it is a cognitive feature of generalized dissociative psychopathology, DDD would be expected to be associated with elevated suggestibility. In addition, we would expect that depersonalization-derealization symptom severity would positively scale with suggestibility, as observed in other conditions (Roelofs et al., 2002). By contrast, responsiveness to verbal suggestions is often conceptualized as a form of compartmentalization wherein one's actions and perceptual states are separated from the antecedent intentions that produced the corresponding responses (Holmes et al., 2005; Brown, 2006). A corollary of this view is that suggestibility will selectively accompany compartmentalization symptomatology and thus should not be observed in DDD (Wieder et al., 2022; Dell, 2019). The factors that moderate this association remain unclear, with mindfulness and imagery as two potential candidates. Previous research suggests reduced mindfulness or metacognition in highly suggestible individuals (Grover et al., 2018; Lush et al., 2016; Pick et al., 2020; Semmens-Wheeler & Dienes, 2012; Terhune & Hedman, 2017) and in the dissociative disorders (Pick et al., 2020; Butler et al., 2019; Michal et al., 2007), as well as a subjective impairment in one's ability to generate visual images in DDD, particularly those in relation to the self or others (Lambert et al., 2001). This research points towards the importance of examining both of these factors in the context of suggestibility in DDD.

This study sought to discriminate between the competing predictions that individuals with DDD would display greater suggestibility than controls or that the two groups would display comparable levels of suggestibility. Individuals with DDD and clinically healthy controls completed a standardized behavioural measure of direct verbal suggestibility and psychometric measures of depersonalization-derealization, mindfulness, anxiety, and imagery vividness. We further evaluated whether depersonalization-derealization symptomatology would moderate any group difference, with the expectation that symptom severity would be associated with greater suggestibility. We also expected that mindfulness would moderate the group differences, with greater suggestibility associated with poorer mindfulness, particularly in the DDD group. Finally, exploratory analyses were conducted to examine whether imagery and anxiety may also play a role in the group differences.

4.3 Material & Methods

4.3.1 Studies

Participants with DDD and clinically healthy controls were drawn from in-person and online variants of a larger study measuring bodily awareness in DDD (see pre-registrations on OSF: https://osf.io/ymz2c, https://osf.io/xtvs8). Further details and results of these two studies are presented in Chapter 5 and Chapter 6 of this thesis. The in-person variant was interrupted in March 2020 due to the COVID-19 pandemic, leading to the implementation of the online variant.

4.3.2 Samples

Participants with DDD were recruited through the Depersonalization Research Unit at King's College London from among those who had previously expressed a willingness to participate in research, a post advertising these studies (in-person and online) on the UK DDD charity website (https://www.unrealuk.org/), social media channels, relevant email lists, and an independent specialist clinic for the assessment and treatment of DDD in London (thedepersonalisationclinic.com). Healthy, age-matched controls were recruited through advertisements, newsletters, and social media. Interested participants were given a detailed information sheet before taking part in a structured telephone screening interview to assess eligibility. All eligible participants provided informed consent in accordance with the Declaration of Helsinki and Goldsmiths, University of London ethical approval and were compensated £40 for completion of both phases of the larger study measuring bodily awareness in DDD (see Chapter 5 and Chapter 6), which included the measures examined in this study.

Participants were included if they met the following criteria: aged 18-70; no previous or current head injury; no severe drug or alcohol use; no neurological disorder; and no severe physical impairment affecting motor performance. Beyond this, individuals with DDD were required to meet DSM-5 diagnostic criteria (American Psychiatric Association, 2013) for current DDD including: having persistent (either chronic or recurrent) episodes of depersonalization and derealization; being aware that their symptoms are a subjective experience; the symptoms cause distress and/or impairment to their functioning; and the symptoms are not better explained by another disorder or substance use. In addition, DDD individuals were also required to have no self-reported comorbid current diagnosis of schizophrenia, other psychotic disorder, or PTSD. Control participants were required to not meet DSM-5 criteria for DDD and have no other self-reported current psychiatric diagnoses. These criteria were assessed as part of a structured telephone screening interview (see **Appendix A2**). To take part in the online study, participants could be residing anywhere worldwide whereas to take part in the in-person study, participants were required to be currently living in London or with access to the city of London. Based on this screening process, five individuals coming forward with DDD either did not meet the DSM-5 diagnostic criteria (*n*=1), or had conflicting comorbidities including self-reported diagnoses of PTSD (*n*=2), visual snow disorder (*n*=1), or DID instead (*n*=1).

This study was part of two larger studies on bodily awareness in DDD, which each included planned sample sizes of 30 individuals with DDD and 30 controls on the basis of an *a priori* power analysis (see Chapter 5 and Chapter 6). 57 individuals with DDD and 39 controls consented to participate, but 2 from the DDD group and 3 controls dropped out post-baseline completion and therefore their data were excluded from these analyses. The final sample for the present study included 55 individuals with DDD and 36 controls, which allowed us to detect group differences corresponding to Cohen's $d \geq .61$ (two-tailed, α=.05, power=.80; conducted using G*Power 3.1; Faul et al., 2009) based on a t-test sensitivity analysis.

4.3.3 Measures

The *Cambridge Depersonalization Scale* (CDS; Sierra & Berrios, 2000) is a 29-item self-report measure of depersonalization and derealization experiences. Respondents rate the frequency (0 ["never"] – 4 ["all the time"]) and duration (1 ["few seconds"] – 6 ["more than a week"]) of different experiences in the preceding six months. If 0 ("never") is endorsed for frequency, a score of 0 is also inferred for duration. As the original study from which these self-reports are drawn concerned week-to-week changes in symptoms, respondents completed the measure with reference to their experiences in the preceding week. Frequency and duration scores are summed with a total scoring range of 0-290 (Cronbach's α = 0.96). The cut-off score for a clinical diagnosis of DDD in 80% of cases is 70 (Sierra and Berrios, 2000). Scores were also calculated for four subscales: emotional numbing (CDS-EN, 6 items; α = 0.86), anomalous body experience (CDS-ABE, 9 items; α = 0.91), anomalous subjective recall (CDS-ASR, 5 items; α = 0.82), and alienation from surroundings (CDS-AfS, 4 items; α = 0.91; Sierra et al., 2005).

The *Brief Suggestibility Scale* (BSS-C; Wieder & Terhune, 2019) is a computerized behavioural scale used to measure non-hypnotic direct verbal suggestibility. This scale has been shown to moderately correlate with a standardized measure of hypnotic suggestibility (Wieder & Terhune, 2019). Respondents are aurally presented with six verbal suggestions for arm heaviness, a dream, hands moving together, an inability to open eyes, arm rigidity, and a music hallucination followed by simple behavioural tests. Respondents subsequently rate the extent to which they had responded to each suggestion according to suggestion-specific behavioural descriptions (e.g. “when you were told to hold out your hand and feel it becoming heavy, did your hand lower at all?”) using a continuous visual analogue scale from 0 (e.g. “My hand did not lower at all”) to 1 (e.g. “My hand lowered all the way down”) for each verbal suggestion followed by a 6-point Likert-scale rating of perceived involuntariness of each response (0 = “did not experience at all”; 1 [voluntary] to 5 [involuntary-automatic]; Bowers, 1981), in order to capture the classic suggestion effect (Weitzenhoffer, 1978) and correct for compliant responses (Bowers et al., 1988). Both the behavioural and involuntariness measures (6-item means) displayed good internal consistency (αs = 0.72, 0.72, respectively). Scores were corrected for compliance by computing the mean of z-transformed (to account for the fact that the two measures are on different scales) behavioural and involuntariness scores (BSS-C; Wieder & Terhune, 2019), which leads to voluntary responses receiving lower scores.

The *Five Facet Mindfulness Questionnaire* (FFMQ; Baer et al., 2006) is a 39-item scale measuring five dimensions of mindfulness: Observing, Describing, Acting with Awareness, Non-Judging, and Non-Reactivity. Items are rated on a Likert scale of 1 (“never or very rarely true”) to 5 (“very often or always true”). As is the case with the CDS, respondents completed this scale with reference to the preceding week. Total scores range from 39-195, with higher scores reflecting increased mindfulness, and subscale scores ranging from 8-40, or 7-35 (Non-reactivity). We were primarily interested in the Acting with Awareness subscale because of the phenomenological similarity with involuntary responses to suggestions; a representative item includes “It seems I am ‘running on automatic’ without much awareness of what I’m doing” (reverse-scored). The FFMQ displayed high internal consistency overall (α = 0.92) and for each subscale: Observing (FFMQ-O, 8 items; α = 0.81), Describing (FFMQ-D, 8 items; α = 0.87), Acting with Awareness (FFMQ-AA, 8 items; α = 0.92), Non-Judging (FFMQ-NJ, 8 items; α = 0.94), and Non-Reactivity (FFMQ-NR, 7 items; α = 0.82).

The *Vividness of Visual Imagery Questionnaire* (VVIQ; Marks, 1973) is a 16-item scale measuring the intensity of imagined visual scenes. The items comprise four groups involving a specific scenario (e.g., “Think of the front of a shop which you often go to. Consider the picture that comes before your mind’s eye”), in response to which participants rate the vividness of specific details within each scenario using a five-point Likert scale (1: “perfectly clear and vivid as normal vision” to 5: “no image at all, you only ‘know’ that you are thinking of the object”) with scores ranging from 16-80. This scale displayed high internal consistency (α = 0.94).

The *Generalized Anxiety Disorder - 7* (GAD-7; Spitzer et al., 2006) is a brief self-report scale of generalized anxiety. The 7 items ask about symptoms over the last two weeks and are rated from 0 (“not at all”) to 3 (“nearly every day”) with total scores ranging from 0-21. The cut-off points for mild, moderate, and severe anxiety are 5, 10, and 15, respectively. A score of 10 or greater acts as the single screening cut-off point with a sensitivity of 89% and a specificity of 82% for GAD (Spitzer et al., 2006). This scale displayed strong internal consistency (α = .91).

4.3.4 Procedure

After a telephone interview and screening to ensure eligibility, and providing informed consent, the BSS-C, VVIQ and GAD-7 were administered to all participants online via Qualtrics (www.qualtrics.com) as part of a baseline battery of measures. Participants in the online study were then sent the CDS and FFMQ via Qualtrics and asked to complete them prior to their first online behavioural session of the larger study whereas participants in the in-person study completed the CDS and FFMQ during their first in-person session of the larger study. A debrief was provided to all participants after completion of the entire study.

4.3.5 Statistical Analyses

All data were analyzed using *R* (Version 4.1.0; R Core Team, 2021). There were no missing data for the in-person participants and in the case of missing data at Time 1 for the online participants, expectation-maximisation was used to estimate any missing data as part of the larger study. There were no missing data for the VVIQ, BSS-C or GAD-7 at baseline, or for the FFMQ at Time 1, and missing data for the CDS at Time 1 was found for 1.5%-5.9% of cases. Little's MCAR test was non-significant, χ^2 (552) = .00, *p* = 1.00, and therefore we assume the data were missing completely at random. The online and in-person subsamples did not significantly differ on any included measures except for anxiety (GAD-7). In the DDD group, anxiety scores were higher in the online subsample than in the in-person subsample (*g* = .83, *p* = .002). This is plausibly attributable to the differential time periods during which the in-person and online subsamples took part in the study, i.e., prior to, and during the COVID-19 pandemic, respectively, given elevated levels of anxiety during the latter period (Kwong et al., 2021; Acenowr & Coles, 2021). The data were normally distributed, as evaluated with QQ plots and Shapiro-Wilk tests, with assumptions of homogeneity of variance met on all measures except for the CDS. One patient was identified as an outlier ($M \pm 2.5$ *SD*s) on the CDS; their score was winsorized to allow for inclusion in the final analyses. The two groups were compared on demographics and psychometric measures using between-groups Welch ANOVAs (DDD vs. controls), with Hedges' *g* as a measure of effect size, and Chi-squared tests. A complementary Bayesian t-test (BF_{10}, default Cauchy prior = .707) was also conducted with BSS-C scores. Next, we performed two moderation analyses on BSS-C scores with Group as a predictor and, alternately, CDS scores and FFMQ-AA subscale scores as moderators. Pearson correlations were computed to assess associations between mindfulness (FFMQ) and suggestibility (BSS-C) in each group separately and the collapsed total sample. Exploratory analyses investigated associations between CDS and FFMQ subscales, VVIQ, GAD-7 and BSS-C scores. All analyses were two-tailed ($\alpha < .05$) except the exploratory correlational analyses which used a lower threshold for significance ($\alpha < .01$).

4.4 Results

4.4.1 Patient and control demographics

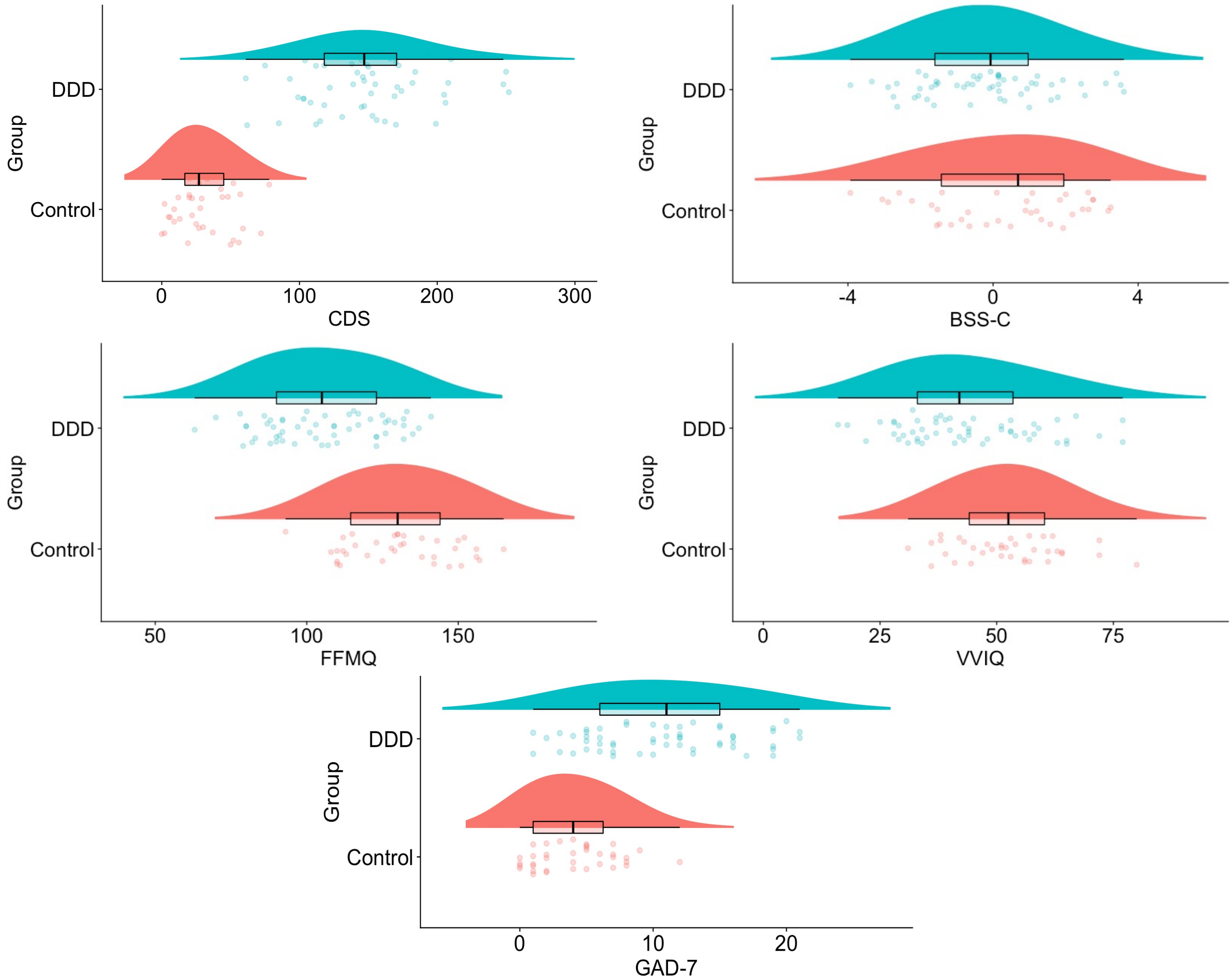
As can be seen in **Table 4.1**, individuals with DDD and controls were relatively well matched on the demographic variables, with a weak trend toward lower education in the former group. Two DDD (4%) individuals scored below the recommended clinical cutoff of 70 on the CDS (Sierra and Berrios, 2000), with the remainder of the group scoring above this threshold. By contrast, only two participants in the control group (6%) scored above this threshold. In turn, individuals with DDD and controls significantly differed on CDS scores (**Table 4.1** and **Figure 4.1**).

Table 4.1 Demographic characteristics and research variables in DDD and controls.

Variable	DDD (*n*=55)	Control (*n*=36)	$\chi2$	*p*	*Φ*
	% (*n*)	% (*n*)			
Education (% university)	62 (34)	81 (29)	2.76	.096	.17
Employment (% employed)	56 (31)	47 (17)	0.41	.52	.07
Gender (% female)	65 (36)	75 (27)	0.54	.46	.08
Location (% in UK)	76 (42)	78 (28)	<0.01	1.00	.00
	***M* (*SD*)**	***M* (*SD*)**	***F (df)***	***p***	***g***
Age	34.9 (13.2)	32.5 (11.3)	0.87 (1, 82.5)	.36	0.19
CDS	149 (43.3)	30.2 (20.3)	309.00 (1, 82.1)	<.001***	3.27
BSS-C	-0.19 (1.8)	0.29 (2.0)	1.38 (1, 69.6)	.24	0.26
FFMQ	105 (19.3)	131 (17.6)	42.20 (1, 79.8)	<.001***	1.38
VVIQ	43.8 (14.6)	52.4 (11.2)	9.86 (1, 86.7)	.002**	0.63
GAD-7	10.7 (5.60)	4.03 (3.05)	54.3 (1, 86.6)	<.001***	1.39

Notes. DDD = depersonalization-derealization disorder; CDS = *Cambridge Depersonalization Scale*; BSS-C = *Brief Suggestibility Scale-Composite*; FFMQ = *Five Facet Mindfulness Questionnaire*; VVIQ = *Vividness of Visual Imagery Questionnaire*. *p<.05; **p<.01; ***p<.001

Figure 4.1 Research variables as a function of group (DDD: *n*=55; Control: *n*=36).



Notes. DDD = depersonalization-derealization disorder; CDS = *Cambridge Depersonalization Scale*; BSS-C = *Brief Suggestibility Scale-Composite*; FFMQ = *Five Facet Mindfulness Questionnaire*; VVIQ = *Vividness of Visual Imagery Questionnaire*; GAD-7 = *Generalized Anxiety Disorder – 7.*

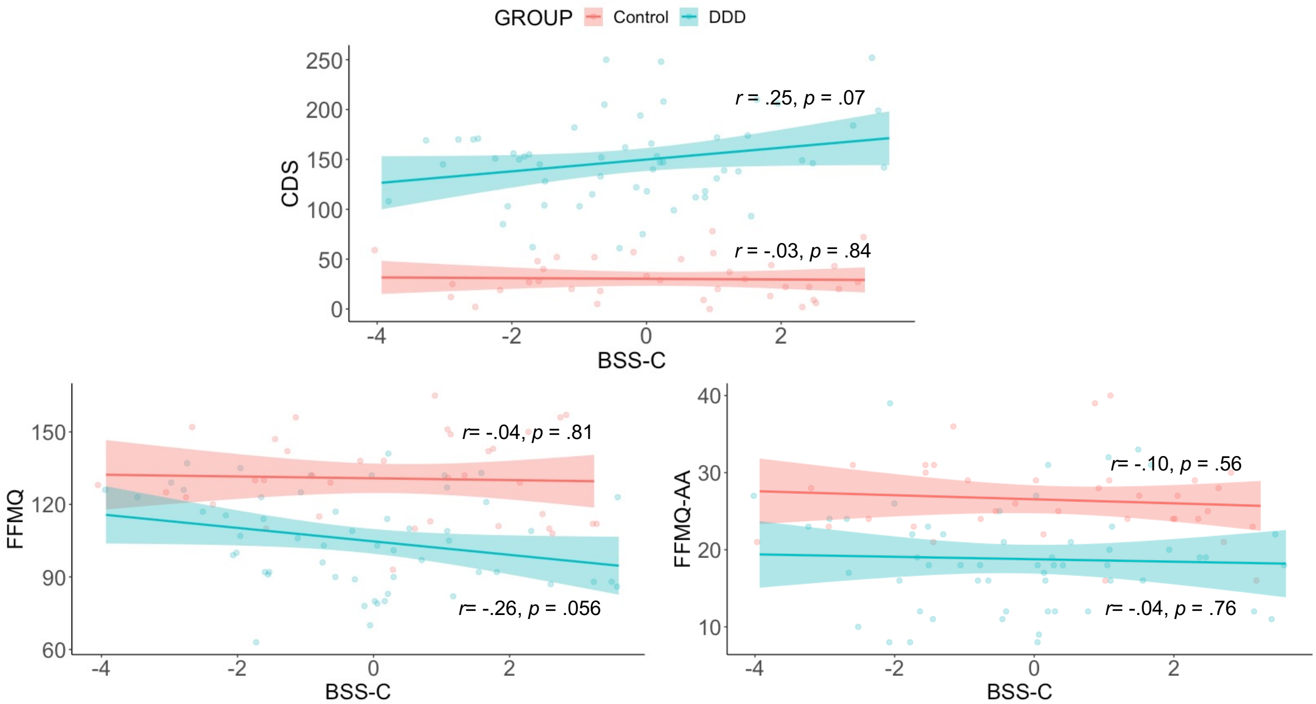
4.4.2 Responsiveness to suggestions

As can be seen in **Table 4.1** and **Figure 4.1**, the DDD group and controls did not significantly differ on suggestibility (BSS-C), with a small effect size reflecting numerically lower suggestibility in those with DDD (g = 0.26). A complementary Bayesian *t*-test using a default prior yielded moderate evidence in favour of the null hypothesis, BF_{10} = .11. This suggests that individuals with DDD and healthy controls were relatively comparable in direct verbal suggestibility, but the results are insensitive with regard to whether the DDD group were lower in suggestibility than controls. This result is at odds with the prediction that individuals with DDD would be more responsive to direct verbal suggestions.

4.4.3 Responsiveness to suggestion and CDS severity

One interpretation of the lack of a robust difference in suggestibility between the DDD group and controls is that such a Group effect is moderated by depersonalization-derealization symptomatology, that is, atypical suggestibility is specific to individuals with DDD with a more severe symptom profile. We evaluated this possibility by assessing whether CDS scores would moderate the association between Group and suggestibility (BSS-C). The overall model was non-significant, $F(3, 87) = 1.52$, $p = .21$, with a non-significant Group x CDS interaction, $b = .01$, $t(87) = 0.82$, $p = .42$, and CDS effects, $b = -.00$, $t(87) = -.21$, $p = .83$, although there was a weak trend toward a Group effect, $b = -2.11$, $t(87) = -1.97$, $p = .051$, with individuals with DDD displaying marginally lower BSS-C scores. Although this analysis suggests that the association between depersonalization-derealization symptoms and suggestibility did not differ between groups, Pearson correlation analyses revealed a suggestive effect in the DDD group (see **Figure 4.2**). In the total collapsed sample, the association between CDS and BSS-C scores was near-zero, $r(89) = -.02$, $p = .83$ [95% CI: -.23, .18], and this held in the controls, $r(34) = -.03$, $p = .84$ [95% CI: -.36, .30]. By contrast, in the DDD group, there was a weak trend towards a positive correlation, $r(53) = .25$, $p = .07$ [95% CI: -.03, .48], though these two group correlations did not significantly differ, $z = 1.28$, $p = .20$. Taken together, these results suggest that responsiveness to verbal suggestions may scale with symptom severity in DDD.

Figure 4.2 Correlations between suggestibility, depersonalization, and mindfulness (DDD: *n*=55; control: *n*=36).



Notes. DDD = depersonalization-derealization disorder; CDS = *Cambridge Depersonalization Scale*; BSS-C = *Brief Suggestibility Scale-Composite*; FFMQ = *Five Facet Mindfulness Questionnaire*; FFMQ-AA = *Five Facet Mindfulness Questionnaire – Acting with Awareness*

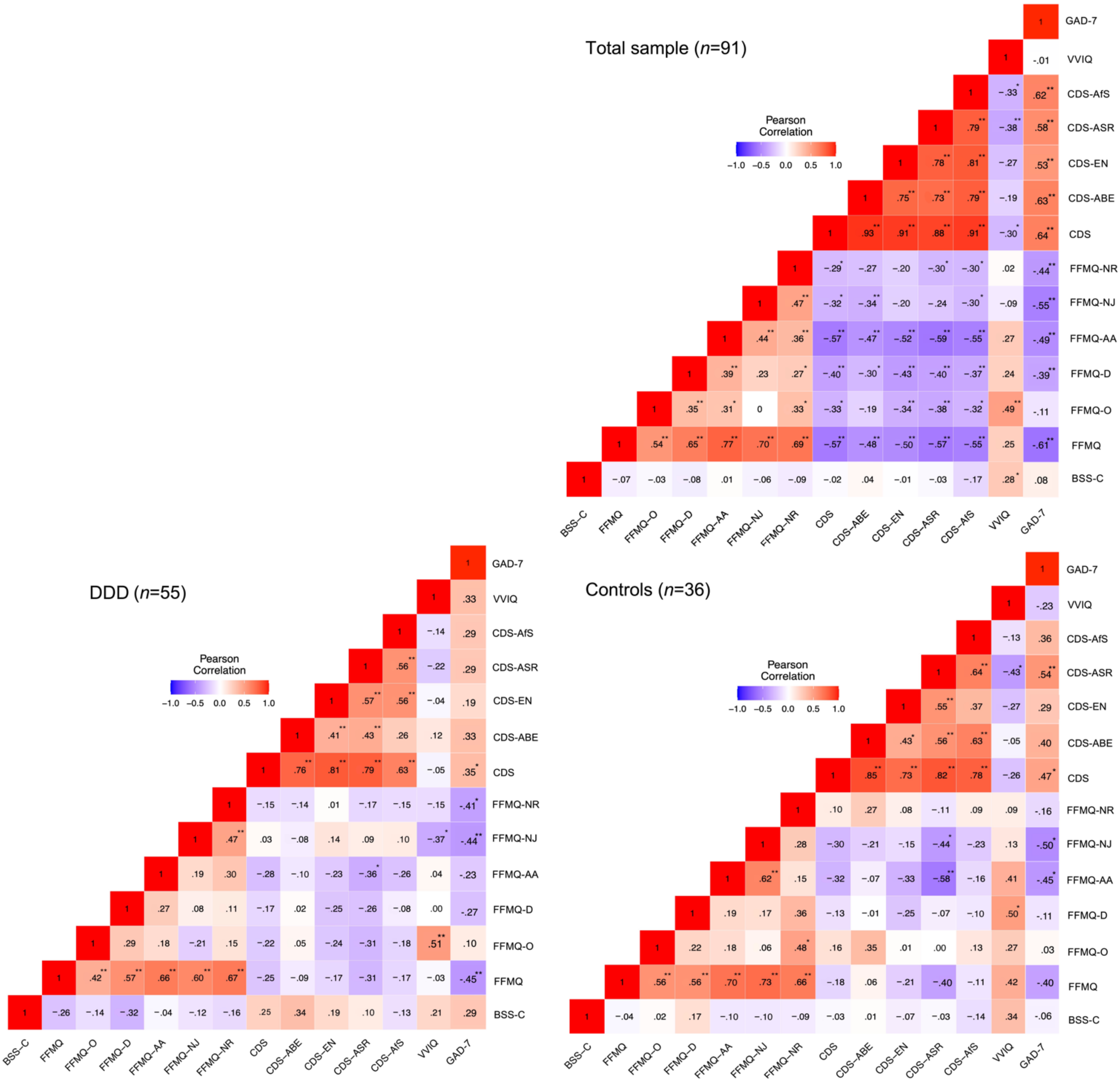
4.4.4 Responsiveness to suggestion and mindfulness

Our second moderation analysis tested the prediction that suggestibility would negatively relate to mindfulness (FFMQ-AA subscale) and that this effect would be more pronounced among the DDD group. The overall model was non-significant, $F(3, 87) = .63$, $p = .60$, with weak non-significant effects for Group, $b = -1.28$, $t(87) = -.71$, $p = .48$, Acting with awareness, $b = -.04$, $t(87) = -.62$, $p = .54$, and their interaction, $b = .03$, $t(87) = .37$, $p = .71$. Correlation analyses between FFMQ-AA and BSS-C scores revealed near-zero associations in the total sample, $r(89) = .01$, $p = .90$ [95% CI = -.19, .22], with similar effects in the DDD group, $r(53) = -.04$, $p = .76$ [95% CI = -.30, .23], and controls, $r(34) = -.10$, $p = .56$ [95% CI = -.41, .24]. Similarly, correlations between total FFMQ and BSS-C scores, did not achieve significance in the total sample, $r(89) = -.07$, $p = .50$ [95% CI: -.27, .14], or controls, $r(34) = -.04$, $p = .81$ [95% CI: -.37, .29], although there was a trend toward a negative correlation in individuals with DDD, *r*(53) = -.26, *p* = .056 [95% CI: -.49, .01]. The latter two effects did not significantly differ, *z* = -1.01, *p* = .31. Collectively, these results suggest that those with DDD who were more suggestible were also less mindful, although this association did not differ from the corresponding effect in controls.

4.4.5 Exploratory analyses

Exploratory analyses investigated associations between the various research measures in the full sample and in the DDD group and control group separately (**Figure 4.3**). Suggestibility and vividness of visual imagery (VVIQ) were significantly positively correlated in the total sample, *r*(89) = .28, *p* = .008 [95% CI = .08, .46], with a similar trend-level effect in controls, *r*(34) = .34, *p* = .043 [95% CI = .01, .60], but a weaker, non-significant effect in the DDD group, *r*(53) = .21, *p* = .12 [95% CI = -.06, .45]. There was a trend-level effect in the DDD group involving the CDS-ABE subscale, implying that those with more severe anomalous bodily experience scores were also more responsive to suggestions, *r*(53) = .34, *p* = .011 [95% CI = .08, .55]; this effect was near-zero and non-significant in the total sample, *r*(89) = .04, *p* = .71 [95% CI = -.17, .24], and in controls, *r*(34) = .00, *p* = .98 [95% CI = -.32, .33] (group correlation difference: *z* = 1.57, *p* = .12). The other CDS subscales (CDS-EN, CDS-ASR, CDS-AfS) revealed non-significant results in all cases (see **Figure 4.3**). A non-significant association between anxiety (GAD-7) and BSS-C scores was found in the total sample, *r*(89) = .08, *p* = .47 [95% CI: -.13, .28], and in controls alone, *r*(34) = -.06, *p* = .74 [95% CI: -.38, .28]. By contrast, in the DDD group, there was trend-level positive correlation, *r*(53) = .29, *p* = .03 [95% CI: .03, .52], suggesting that those individuals with more severe anxiety were also more responsive to suggestions, although these two group correlations did not significantly differ (*z* = -1.61, *p* = .11). Separate analyses of the two aspects of the BSS-C, behavioural and involuntariness, revealed nonsignificant results in all cases, *r* range: -0.07 – 0.26, all *p*s >.06, indicating that the DDD group was not characterized by significantly higher scores on either scale of the BSS-C. Finally, exploratory analyses between suggestibility and mindfulness subscales revealed non-significant results in all cases. Beyond this, as seen **Figure 4.3**, the CDS and FFMQ, both total and subscales, are reliably negatively correlated in the total sample. This is most notable for the FFMQ-AA subscale with the CDS-ASR subscale, which is reliably negative in the total sample, as well as in patients and controls separately.

Figure 4.3 Correlations among all research variables. Data reported include Pearson correlation coefficients.



Notes. DDD = depersonalization-derealization disorder; BSS-C = *Brief Suggestibility Scale-Composite*; FFMQ-O = *Five Facet Mindfulness Questionnaire - Observing*; FFMQ-D = *Five Facet Mindfulness Questionnaire – Describing;* FFMQ-AA = *Five Facet Mindfulness Questionnaire – Acting with Awareness;* FFMQ-NJ = *Five Facet Mindfulness Questionnaire – Non-judging;* FFMQ-NR = *Five Facet Mindfulness Questionnaire – Non-reacting;* CDS-ABE = *Cambridge Depersonalization Scale –* Anomalous bodily experience; CDS-EN = *Cambridge Depersonalization Scale* – Emotional numbing; CDS-ASR = *Cambridge Depersonalization Scale* – Anomalous subjective recall; CDS-AfS = *Cambridge Depersonalization Scale* – Alienation from surroundings; VVIQ = *Vividness of Visual Imagery Questionnaire*; GAD-7 = *Generalized Anxiety Disorder – 7.* *p < .01; **p < .001.

4.5 Discussion

On the basis of previous research highlighting elevated hypnotic suggestibility as a characteristic of dissociative psychopathology (Wieder et al., 2022; Mertens et al., 2018), this study investigated whether DDD is similarly characterized by aberrant responsiveness to direct verbal suggestions. The analyses revealed that individuals with DDD and demographically matched controls did not significantly differ with regard to suggestibility with Bayesian evidence for the null hypothesis that the DDD group was not higher in suggestibility than controls. However, there were weak trends for responsiveness to suggestions to be associated with the severity of depersonalization-derealization symptoms, particularly anomalous bodily experiences. In accordance with reports of attenuated mindfulness in high dissociation (Michal et al., 2007; Nestler et al., 2015) individuals with DDD also displayed lower mindfulness (FFMQ) than controls. These results indicate that DDD is not characterized by elevated direct verbal suggestibility and provide further insights into the aetiology and mechanisms of this condition and its status within the taxonomy of the dissociative disorders.

These results stand in stark contrast with the prediction that individuals with DDD, like those with other dissociative disorders, would be more responsive to direct verbal suggestions. However, the results do align with the possibility that elevated suggestibility is specifically linked to compartmentalization, and not detachment, symptoms and is not seen in anxiety disorders (Spinhoven et al., 1991). Within the diagnosis of DDD, there is diverse symptomatology that overlaps with both anxiety and other dissociative disorders (Lyssenko et al., 2018; Wells & Matthews, 1994; Hunter et al., 2003; Hunter et al., 2014). In particular, most dissociative disorders such as dissociative amnesia and dissociative identity disorder are typified by compartmentalization symptoms including behavioural or emotional dysregulations, memory or identity disturbances, or functional neurological symptoms (Spitzer et al., 2006). By contrast, DDD is primarily characterized by detachment from one's body, mental states, or sense of self (depersonalization) and/or from one's surroundings (derealization; Hunter et al., 2014). Recent work examining heterogeneity in DDD (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021) yielded evidence for five distinct classes of DDD patients: three comprising subtypes based on severity (Low severity, Moderate severity, High severity), and two subtypes differing on detachment and compartmentalization (High depersonalization, High dissociation) symptomatology (Holmes et al., 2005; Brown, 2006). Accordingly, one interpretation of the present results is that elevated suggestibility is specific to a high dissociation (compartmentalization) subtype that possesses a more similar symptom profile to other dissociative disorders, or a high severity subtype, that also includes more severe anxiety, given the current trend towards more severe depersonalization-derealization symptoms as well as anxiety symptoms being associated with heightened suggestibility. It is also important to note that the null result seen within this study may be specific to DDD and not necessarily reflective of a null association between depersonalization-derealization symptoms and suggestibility more broadly.

Another route for interpreting the apparent discrepancy between these results and evidence for elevated suggestibility in the dissociative disorders (Wieder & Terhune, 2022) is the relationship between DDD and trauma. Whilst trauma is the primary antecedent of the dissociative disorders (Dalenberg et al., 2012; Lynn et al., 2019; Vonderlin et al., 2018), precipitating factors for DDD are more varied and include substance use, depression, and panic (Baker et al., 2003; Millman et al., 2022; Simeon et al., 2003) with lower prevalence rates of self-reported childhood trauma (Baker et al., 2003; Lotfinia et al., 2020; Bryant et al., 2001). Further, it has been suggested that depersonalization and derealization may stem from overwhelming anxiety, which is not necessarily traumatic (Soffer-Dudek, 2014; Buchnik-Daniely et al. 2021). Accordingly, insofar as elevated direct verbal suggestibility is observed in dissociative, trauma and stressor-related disorders, such as PTSD (Wieder et al., 2022; Bell et al., 2011; Dell, 2017; Terhune & Cardeña, 2015; Bryant et al., 2001; Spiegel et al., 1988) and hypnotic suggestibility has been repeatedly shown to positively covary with posttraumatic symptoms (DuHamel et al., 2002; Keuroghlian et al., 2010; Yard et al., 2008), elevated suggestibility is potentially specific to those suffering from trauma-related dissociative symptoms (Putnam et al., 1995). At present, this interpretation is not discriminable from the view that elevated suggestibility is specific to compartmentalization symptomatology.

Previous research has demonstrated negative associations between mindfulness or metacognition and suggestibility (Grover et al., 2018; Lush et al., 2016; Semmens-Wheeler & Dienes, 2012; Terhune & Hedman, 2017) implying that responsiveness to suggestion is supported by, or related to, aberrant metacognition pertaining to one's intentions and the factors influencing their sense of agency (Kirsch & Lynn, 1998; Dienes & Perner, 2007). Similarly, preliminary research points to attenuated mindfulness in highly dissociative individuals (Pick et al., 2020; Butler et al., 2019; Michal et al., 2007; Nestler et al., 2015) and to attenuated intention awareness in germane populations (Jungilligens et al., 2019; Baek et al., 2017). On the basis of this research, we examined whether suggestibility in individuals with DDD would be associated with, or moderated by, levels of mindfulness. In preliminary support of the former prediction, we observed a borderline significant negative correlation in the DDD group, but not in the control group, or the total sample. This points to a potential role of lower mindfulness or poorer metacognition supporting greater responsiveness to suggestion in DDD that warrants greater attention in this population and in dissociative psychopathology more broadly.

The observation of no difference in suggestibility between our sample of DDD individuals and clinically healthy controls is potentially attributable to our observation of attenuated mindfulness and imagery in the DDD sample. Lower mindfulness in DDD patients, as observed here and suggested elsewhere (Nestler et al., 2015), paired with elevated depersonalization-derealization symptoms, may be linked to reduced interoceptive awareness, an overall awareness and understanding of the body (Buledo, 2015). It is possible that a certain level of awareness of the internal state of the body is necessary to experience suggested changes in behaviour and perception (Diolaiuti et al., 2019) and a range of research points towards underactivity in brain areas associated with interoception in DDD (Phillips et al., 2001; Sierra & David, 2011; Seth, 2013; Schulz, 2016). Similarly, this study replicates previous results (Lambert et al., 2001) suggesting that DDD patients display impairments in imagery compared to controls, particularly regarding self-related imagery. Further previous findings revealed that responsiveness to suggestion does not reliably correlate with imagery, and the two seem to recruit distinct neurocognitive mechanisms (Terhune and Oakley, 2020). However, there is some evidence that individuals with poor imagery are less responsive to suggestion, hinting that some imagery capacity may be necessary, but not sufficient, to respond to suggestions (Terhune and Oakley, 2020; Sheehan and Robertson, 1996). Along these lines, we observed a significant positive correlation between suggestibility and vividness of visual imagery in the total sample, with a trend-level effect in controls but not in the DDD group. This potentially aligns with previous research demonstrating evidence for a low dissociative, highly suggestible subtype in the general population that has superior visual imagery (Terhune and Cardeña, 2011). Taken together, these results suggest that aberrant interoceptive awareness and imagery in DDD may help to explain the absence of elevated suggestibility in this population.

These results have potential implications for therapeutic interventions in DDD. Insofar as suggestibility predicts treatment outcome with suggestion-based therapies (e.g., hypnotherapy; Montgomery et al., 2011; Milling et al., 2021), the present results imply that these techniques are unlikely to be efficacious in this population. By contrast, given that we observed that individuals with DDD were characterized by reduced mindfulness, and mindfulness, particularly acting with awareness, tended to be negatively correlated with depersonalization-derealization symptoms, mindfulness-based treatments are probably a better target than suggestion-based treatments in DDD. Previous research has recommended training in mindfulness techniques as a potential therapeutic approach for DDD (Nestler et al., 2015), with indications that mindfulness exercises, specifically mindful breathing, can immediately reduce present state depersonalization in patients with DDD (d = .65; Michal et al., 2013).

Although these results should be interpreted with caution, they align with previous research showing that atypical suggestibility is specific to dissociative and germane disorders characterized by compartmentalization symptomatology (Brown, 2006), such as dissociative identity disorder (Dale et al., 2009) and is positively related to functional and/or dissociative symptoms in functional neurological disorder (Roelofs et al., 2002; Moene et al., 2001). These results shed new light on the relationship between responsiveness to suggestion and dissociative psychopathology but should be considered in the context of multiple limitations. As the suggestibility assessment was online and unsupervised, we were unable to corroborate whether participants were complying with the experimental protocol, although use of this suggestibility scale has previously been shown to correlate with dissociative tendencies in a non-clinical sample (Wieder & Terhune, 2019). It is also possible that the DDD group perceived the suggestibility assessment to index imagination and thus inferred that the procedure aimed to evaluate whether they were imagining their own symptoms (Brown, 2006). Accordingly, it may be valuable to measure suggestibility in DDD in a manner that doesn't overtly reference imagination. Further, one notable confound of standardized suggestibility scales is that they include suggestions for dissociative and functional symptoms (i.e., amnesia, hallucinations, etc.) and it has been shown, for example, that FND patients are hyperresponsive to suggestions that modulate their symptoms (Wieder et al., 2022). This suggests the possibility that elevated suggestibility in the dissociative disorders and FND is artefactual of the suggestion content of these scales. In turn, it will be imperative for future research on elevated suggestibility in dissociative psychopathology to include suggestions targeting non-dissociative, non-functional experience and symptoms (e.g., elevated positive affect). Conversely, it remains unexplored whether individuals with DDD would be more responsive to suggestions for the modulation of their detachment symptoms. If so, this may prove valuable in aiding the diagnosis of DDD, as suggestive symptom induction is widely used to aid the diagnosis of FND (Popkirov et al., 2020; Gras et al., 2021). Another important consideration is the reason for particularly low prevalence rates of trauma in DDD specific samples. It is possible that this is due to a bias of referral pathways within clinical services: if patients report trauma, they will be referred to trauma focused services, leaving DDD specialist services and the research samples drawn from these predominantly seeing patients for whom these trauma referral pathways were not open. Beyond this, a further limitation is that we did not formally assess the presence of other dissociative disorders, such as dissociative amnesia or DDNOS. It is important that symptom overlap between DDD and other dissociative disorders as well as dissociative disorder comorbidities are considered in future research examining responsiveness to suggestion in DDD. Further, including a range of dissociative disorder samples in future research exploring this question would help to better parse out the differences among dissociative disorders in relation to suggestibility. Lastly, studies exploring the links between dissociation and suggestibility often use the Dissociative Experiences Scale (DES; Carlson & Putnam, 1993). Since DDD may manifest as experiences of detachment and less so of compartmentalization, the CDS, as used in this study, is a valuable measure of this condition and the specific types of dissociation that DDD patients experience. However, future research on DDD and suggestibility should also include the DES to assess broader dissociative symptomatology and its relationship to suggestibility in DDD. Including this measure, along with the CDS, would also help to differentiate ostensible subtypes present within the DDD population (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021) and to evaluate our hypothesis that elevated suggestibility is specific to individuals with DDD experiencing compartmentalization symptoms. This and previous work (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021) suggests that DDD may not be best placed within the rubric of dissociative disorders and might be considered a distinct psychopathological syndrome.

Bodily awareness in DDD

The previous Chapters have helped to better characterize and understand DDD as a unique psychopathological disorder. The discovery of latent subtypes, experiencing varying levels of detachment and compartmentalization, as well as the finding that individuals with DDD and demographically matched controls do not significantly differ with regard to suggestibility but do experience reduced mindfulness, provides new insights into the aetiology and mechanisms of this condition and its status within the taxonomy of the dissociative disorders. The results across these two chapters also have potential implications for directing tailored treatment. Moving forward with this better understanding of DDD, the next section of this thesis shifts more specifically into the relationship between DDD and the body, with a focus on dance/movement therapy for depersonalization. As explored earlier in this thesis, DDD involves experiences of detachment and disembodiment, which may partly reflect altered or deficient interoceptive processing (Sedeno et al., 2014; Seth et al., 2011; Gatus, Jamieson, & Stevenson, 2022). Since DDD is so inherently tied to a detachment from the physical body, this could be a crucial missing piece in the treatment of this disorder. A focal point of DMT or body-based therapies is an interconnection of the mind and body, making these potentially useful forms of treatment in DDD, working from the bottom-up to alter deficient or maladaptive interoceptive processing whilst simultaneously enhancing interoceptive awareness and mindfulness (Cruz, 2016). Across the next two Chapters, DDD is presented as a suitable candidate for dance/movement interventions. Chapter 5 presents an online intervention study and Chapter 6 presents an in-person intervention study implementing two, controlled dance tasks to differentially engage with the body. Both of these Chapters present dance/movement as a bespoke and efficacious tool to reduce bodily detachment whilst improving a sense of body awareness in DDD.

5. Online dance movement therapy reduces bodily detachment in depersonalization-derealization disorder

5.1 Abstract

Depersonalization-derealization disorder (DDD) involves a sense of bodily detachment. To address this, we developed two online dance tasks to train body awareness (BA) or to enhance the saliency of bodily signals through dance exercise (DE). Individuals with DDD (*n*=31) and healthy controls (*n*=29) performed both tasks in a cross-over design. We assessed depersonalization-derealization symptom severity, interoceptive awareness, mindfulness, and body vigilance before, during and after the tasks. Both tasks reduced symptoms in the DDD group, though dance exercise was perceived as easier. The DE task increased mindfulness in those with DDD more than the BA task, whereas controls showed the opposite pattern. In the DDD group, within-subject correlations showed that reductions in symptoms were associated with task-specific improvements in interoceptive awareness and mindfulness. Dance offers an efficacious tool to reduce symptoms in DDD and can be tailored to address specific components of a mindful engagement with the body.

5.2 Introduction

Existing therapies for DDD are by and large talking therapies including Cognitive Behavioural Therapy and Psychodynamic Therapies (Patrikelis et al., 2021), yet "if detachment is conceptualized as a separation from a sense of self and/or the environment, treatment should focus on grounding and orientation to the self and the here and now" (Jorba-Galdos, 2014, p. 468). Wallman-Jones, Perakakis, Tsakiris, and Schmidt (2021) point towards a feedback loop between physical activity and interoceptive processing, where these both may reciprocally influence one another. One form of physical activity that could be particularly useful in potentially altering interoceptive processing and enhancing interoceptive awareness and mindfulness in DDD is dance (Chapter 1; Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020). If DDD is indeed linked to a reduced awareness of bodily sensations, it may be more directly and effectively addressed by *generating* mindful body movements and experiences rather than *discussing* their absence. Indeed, mindfulness has also been shown to be reduced in DDD (Michal et al., 2013; Nestler, Sierra, Jay, & David, 2015; Millman, Hunter, David, Orgs, & Terhune, 2022), which may be linked to the suggested deficits in interoceptive awareness.

Here, we report an online study that deploys dance/movement as a tool to develop a greater awareness of one's body in people with DDD and a control group of clinically healthy individuals. To help control for the influence of physical exercise (Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020) we developed two dance tasks to be performed over two, two-week periods, each including three online video sessions and 12 days of at-home practice. The body awareness (BA) task aims to explicitly direct attention towards the body, whereas the dance exercise (DE) task aims to implicitly boost the salience of bodily signals. We were interested in determining, in the context of DDD, if it is more effective to explicitly focus on bodily sensations, or to implicitly enhance the salience of bodily signals through dance-based aerobic exercise. The tasks that we developed for, and used within, this study differ from traditional Dance Movement Therapy (DMT) in a range of ways. Traditional DMT involves heterogeneous and idiosyncratic approaches (Brauninger, 2014) that are often identified by each individual therapist who will mould a practice that matches the abilities, requirements, and individual styles of their clients (ADTA, 2015). Sessions may include improvised or authentic movement (Whitehouse, 1999), creativity and self-expression, and the exploration of specific themes relevant to the clients taking part in the session. These sessions also rely quite heavily on the relationship between the client and the therapist. It was a focal goal of this study to develop tasks that were less interpretative and exploratory than traditional DMT, and instead more structured and manualized for the purposes of generalizability and replicability with an aim towards better pinpointing the key elements and mechanisms that may underlie the clinical efficacy of dance/movement therapies. Further, the use of two different types of dance tasks, rather than the inclusion of a waiting-list control condition, is of particular importance to this research and differs from a large majority of DMT research. An overwhelming amount of research implementing DMT, or body-based treatments compare intervention and no-intervention (control) groups (Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020; Hildebrandt et al., 2016). These studies often show improvements in the intervention group (Koch et al., 2019; Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020), rather than comparing two different types of dance/movement interventions or comparing DMT to aerobic exercise (e.g., running, cycling). Similarly, existing DMT interventions are almost always performed in group settings ("What is dance/movement therapy?," 2014), yet moving in groups enhances mood and feelings of social belonging (von Zimmermann et al., 2018). To control for such social influences on treatment effectiveness, both tasks in our study were instead performed alone and at home.

We hypothesize that the clinically healthy control group will exhibit superior interoception and mindfulness as compared to the DDD group at baseline, with these differences remaining post-intervention. Depersonalization-derealization (DD) symptoms will decrease in the DDD group, and interoceptive awareness and mindfulness will improve in both the DDD group and control group after the dance tasks. We predict that both tasks will reduce bodily detachment in DDD but may do so by affecting different components of interoceptive awareness and mindfulness. More specifically, if an explicit attention to bodily sensations is helpful, then we would expect the body awareness (BA) task to decrease DD symptoms including anomalous bodily experiences, improve interoceptive awareness, and improve mindfulness. However, if an implicit awareness of the body via increasing the salience of bodily signals is helpful, then we would expect the dance exercise (DE) task to do the same. Moreover, we expect that reductions in DD symptoms will scale with improvements in mindfulness and interoception. Finally, daily state depersonalization scores will decrease across the two weeks, and this will be positively associated with a decrease in trait depersonalization scores.

5.3 Materials and Methods

5.3.1 Participants

Participants with DDD were recruited online through the UK DDD charity *Unreal* (https://www.unrealuk.org/) and relevant social media channels, and through referrals from an independent specialist clinic for the assessment and treatment of DDD in London (thedepersonalisationclinic.com). Healthy controls were recruited online through advertisements, social media and newsletters at Goldsmiths, University of London as well as on general public sites. Interested participants were sent an information sheet before a phone screening to assess eligibility. All eligible participants provided informed consent in accordance with the Declaration of Helsinki and ethical approval from the research ethics committee at Goldsmiths, University of London. All participants received £40 for completion of both phases of the study.

Participants from both groups were included if they met the following criteria: aged 18-70; no previous or current head injury; no severe drug or alcohol use; no neurological disorder; and no severe physical impairment affecting motor performance. As the study took place entirely online, participants could be located anywhere worldwide. To qualify for the DDD group, all participants were required to meet DSM-5 (300.6) diagnostic criteria (American Psychiatric Association, 2013) for current DDD including: chronic or recurrent episodes of depersonalization and derealization; awareness that their symptoms are a subjective experience; the symptoms cause distress and/or impairment to their functioning; and the symptoms are not better explained by another disorder or substance use. In addition, DDD participants were also required to have no self-reported comorbid current diagnosis of schizophrenia, PTSD, or other psychotic disorder. To qualify for the control group, all participants were required to not meet DSM-5 diagnostic criteria for DDD and have no other self-reported current clinical psychiatric diagnoses. These criteria were assessed as part of a structured telephone screening interview, designed with a clinician with expertise on DDD (see **Appendix A2**).

An effect size of the impact of the tasks on DD symptoms was estimated from a study examining changes in body image among depressed adult outpatients after a DMT treatment (Pylvanainen & Lappalainen, 2018), as this was the closest study found to make an appropriate effect size estimation. Body image, as it was measured within this study (Pylvanainen & Lappalainen, 2018) was the most relevant dependent variable among potentially relevant studies given its inclusion of questions regarding feelings of embodiment and body perception. Further, this study involved the use of a body/movement-based intervention (DMT) in a clinical mental health population which, as described in this thesis, is still quite hard to come by. Although our study was not using traditional DMT, it was crucially working with the body and using dance-based tasks in an attempt to reduce symptoms and improve a sense of awareness and mindfulness within the body. Their effect size for the difference between pre- and post-DMT intervention for the sum of questions asked on the Body Image Assessment (BIA; Pylvanainen, 2003) was medium to large, d=0.73. This was the more conservative estimate reported within their study, based on ratings from a group of dance movement therapists who were outside the study in an effort to enhance objectivity and check the reliability of assessments being conducted by the researchers of the study. Using this effect size estimate, we performed an *a priori* sample size estimation (two-tailed α=0.05, power=0.90, 1:1 group ratio), which yielded a required sample size of 22 participants in the DDD group. As we were recruiting a clinical population, which proves challenging in many instances, we wanted to recruit more than the minimum required sample size to not only account for attrition and poor data quality, but also in case the true effect was indeed smaller based on the fact that the comparison we were using when determining the effect size was slightly different, though still relevant, to our planned protocol. Because of this, we aimed to include a minimum of 30 participants per group, which also took into account limits on time, resources, and conducting this study during the COVID-19 pandemic.

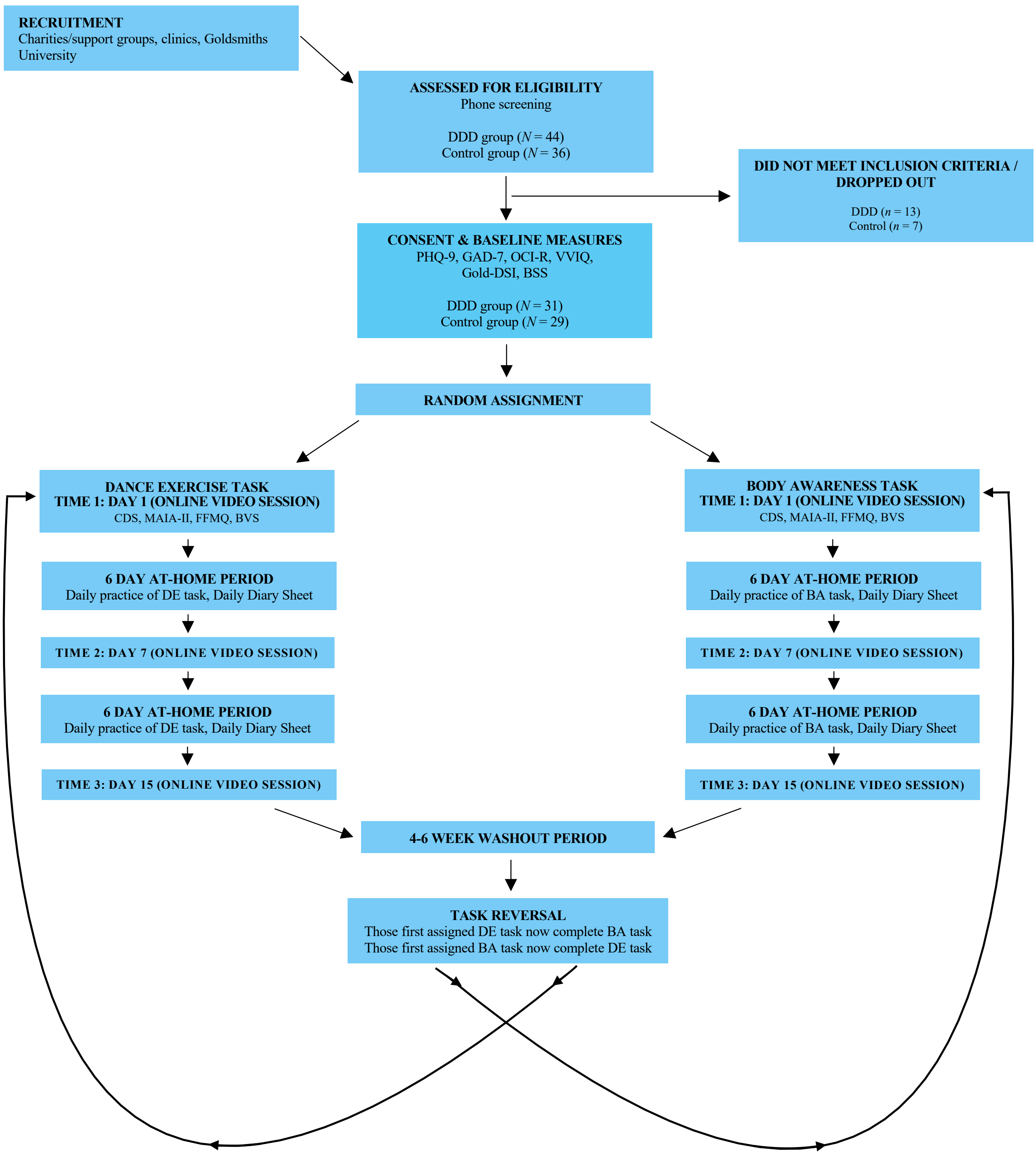
We recruited a total of 44 participants with DDD and 36 healthy, demographically matched controls. Nine participants in the DDD group dropped out at various points across the study period and four did not meet inclusion criteria due to differential diagnosis and/or the presence of PTSD. Three controls dropped out across the study period and four did not meet inclusion criteria due to the presence of other psychiatric disorders or having symptoms of DDD.

The final sample of participants who met our inclusion and exclusion criteria and did not drop out at any point across the study period comprised 31 individuals with DDD and 29 controls. All participants with DDD experienced DD symptoms chronically, on a daily basis, with the length of time of experience ranging from 1.5 – 50 years (*M* = 11.6 years). The two groups were well-matched on demographic variables including age (DDD group: *M* = 32.97, *SD* = 12.1; controls: *M* = 31.8, *SD* = 11.8), gender (DDD group: 68% female, 32% male; control group: 72% female, 28% male), employment status (DDD group: 48% employed; controls: 48% employed) and physical activity (DDD group: 58% performing physical activity 3x per week or more; controls: 62% performing physical activity 3x per week or more). There was a weak trend toward lower education in the DDD group ($\chi2$ = 3.91, p = .048, Φ = 0.26), and participants with DDD reported more frequently to be taking medication ($\chi2$ = 8.59, p = .003, Φ = 0.38). 15 participants with DDD self-reported taking the following medications: antidepressants (fluoxetine [4], citalopram [3], sertraline [2], mirtazapine [1]), benzodiazepines (diazepam [2], lorazepam [2], clonazepam [2]) and unspecified (5), and three [10%] controls reported taking medication for generalized anxiety. 12 (39%) participants in the DDD group were concurrently undergoing therapy including CBT (3), counselling (3) and unspecified (6) (no controls reported to be receiving psychotherapy). 19 participants with DDD and 21 controls were currently living in England, with the rest residing in Scotland, France (2), Ireland (2), Italy (2), USA (5), Croatia, Spain, Egypt, Germany, Slovakia (3), and Brazil.

5.3.2 *Design and procedure*

A crossover design was used in which both dance tasks (BA and DE) were sequentially completed by all participants (DDD group and controls) in counterbalanced order (see **Figure 5.1**). Participants were taught one of the two tasks (BA or DE) during the first online video session with the first author, and then asked to perform the task at home once per day across a period of six days. For both tasks, participants were provided with audio recordings of the warmup and task itself to guide them through the tasks at home. All participants had a second online video session on the seventh day of the study to check-in and discuss the participant's experience of the task thus far. Participants then continued to perform the task once per day across the second six-day period (12 days of daily task performance total). A washout period of four to six weeks separated the two tasks to minimize the risk of carry-over effects. After the washout period, participants were taught the other task and the same procedure (over two weeks) was repeated.

Figure 5.1 Flow chart of study design.



Notes. GAD-7 = *Generalized Anxiety Disorder-7*; PHQ-9 = *Patient Health Questionnaire-9*; OCI-R = *Obsessive Compulsive Inventory Revised*; VVIQ = *Vividness of Visual Imagery* Questionnaire; Gold-DSI = *Goldsmiths Dance Sophistication Index*; CDS = *Cambridge Depersonalization Scale*; FFMQ = *Five Facet Mindfulness Questionnaire*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness*; BVS = *Body Vigilance Scale*.

5.3.3 *Measures*

5.3.3.1 Baseline measures

At baseline, prior to taking part in the tasks, all participants completed measures of depression, anxiety, obsessive compulsive disorder, visualization, and dance engagement and experience, as well as non-hypnotic direct verbal suggestibility (data reported in Chapter 4; Millman, Hunter, David, Orgs, & Terhune, 2022).

The *Patient Health Questionnaire – 9* (PHQ-9; Kroenke, Spitzer, & Williams, 2001) was used to measure depressive symptom severity (Kroenke & Spitzer, 2002). This scale indexes symptoms over the last two weeks with items rated from 0 (“not at all”) to 3 (“nearly every day”) with total scores ranging from 0-27 with a separate tenth question concerning one’s level of functional impairment. It is recommended that a score of 10 is used as a threshold for depression as this score has a sensitivity and specificity of 88% for major depression (Kroenke & Spitzer, 2002). This scale displayed strong internal consistency (α = .93).

The *Generalized Anxiety Disorder - 7* (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006) is a brief self-report scale of generalized anxiety. The 7 items ask about symptoms over the last two weeks and are rated from 0 (“not at all”) to 3 (“nearly every day”) with total scores ranging from 0-21. In alignment with the PHQ-9, a score of 10 or greater acts as the single screening cut-off point with a sensitivity of 89% and a specificity of 82% for GAD (Spitzer, Kroenke, Williams & Lowe, 2006). The GAD-7, like the PHQ-9, also includes a rating of functional impairment. This scale exhibited high internal consistency (α = .91).

The *Obsessive-Compulsive Inventory Revised* (OCI-R; Foa et al., 2002) is an 18-item self-report scale used to screen and assess symptoms of obsessive-compulsive disorder (OCD). Items are scored on a five-point Likert scale from 0 (“not at all”) to 4 (“extremely”) with total scores ranging from 0-72. The recommended cutoff score indicating a probable diagnosis of OCD is 21. This scale displayed high internal consistency (α = .90).

The *Vividness of Visual Imagery Questionnaire* (VVIQ; Marks, 1973) is a 16-item scale measuring the vividness or intensity of imagined visual scenes. The 16 items comprise four groups of four items, with each item rated on a five-point Likert scale (1: "perfectly clear and vivid as normal vision" to 5: "no image at all, you only 'know' that you are thinking of the object") with scores ranging from 16-80. Each group of items presents a different scenario, and the respondent is asked to rate the vividness of specific details within each scenario. This scale displayed high internal consistency (α = .95).

The *Goldsmiths Dance Sophistication Index-II* (Gold-DSI; Rose, Mullensiefen, Lovatt, & Orgs, G., 2020) is a 26-item self-report scale that measures participatory and observational dance experience. The participatory factor has one general factor and four subscales (body awareness, urge to dance, social dancing and dance training), and observational dance training has only one factor. Higher scores overall are indicative of increased experience and engagement with dance. This measure and its subscales displayed high internal consistency (α = .94; body awareness: α = .87; urge to dance: α = .92; social dancing: α = .80; dance training: α = .83).

5.3.3.2 Weekly measures

At three time points across each of the two-week testing periods (Day 1: Time 1, Day 8: Time 2 and Day 15: Time 3; see **Figure 5.1** for more details), all participants completed self-report measures of depersonalization-derealization, interoceptive awareness, mindfulness, and body vigilance.

The *Cambridge Depersonalization Scale* (CDS; Sierra & Berrios, 2000) is a 29-item self-administered questionnaire designed to measure both trait depersonalization and derealization experiences. Respondents rate the frequency (0 ["never"] – 4 ["all the time"]) and duration (0 ["few seconds"] – 6 ["more than a week"]) of these different experiences in the preceding six months. As this research is concerned with week-to-week changes in symptoms, the instructions for this questionnaire were adjusted to ask respondents about their symptoms in the preceding week. Frequency and duration scores are summed across all items, with a total scoring range of 0-290. The cut-off score for a clinical diagnosis of DDD in 80% of cases is 70 (Sierra & Berrios, 2000). This measure displayed high internal consistency (α = .97). Scores were also calculated for four subscales: emotional numbing (6 items; α = .85), anomalous body experience (9 items; α = .93), anomalous subjective recall (5 items; α = .82), and alienation from surroundings (4 items; α = .93) (Sierra et al., 2005).

The *Multidimensional Assessment of Interoceptive Awareness – II* (MAIA-2; Mehling et al., 2018) is a 37-item self-report questionnaire of interoceptive awareness measuring perceptions of and reactions to bodily sensations. This questionnaire measures eight dimensions of interoceptive awareness: Noticing, Not Distracting, Not Worrying, Attention Regulation, Emotional Awareness, Self-Regulation, Body Listening, and Trusting. Each question is scored on a Likert-type scale from 0 (“never”) to 5 (“always”). In addition to the average scores for all eight subscales, we also calculated the mean score across the entire scale. Higher scores are indicative of higher body awareness. This scale displays high internal consistency overall (α = .92) and for each subscale: Noticing (4 items; α = .76), Not Distracting (6 items; α = .89), Not Worrying (5 items; α = .81), Attention Regulation (7 items; α = .89), Emotional Awareness (5 items; α = .86), Self-Regulation (4 items; α = .86), Body Listening (3 items; α = .89), and Trusting (3 items; α = .90).

The *Five Facet Mindfulness Questionnaire* (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) is a 39-item scale measuring trait mindfulness in everyday life. The scale assesses five core features of mindfulness: Observing, Describing, Acting with Awareness, Non-Judging, and Non-Reactivity. Each of the 39 items is rated on a Likert scale of 1 (“never or very rarely true”) to 5 (“very often or always true”). As done with the CDS, the instructions for this questionnaire were adjusted to ask respondents about these statements across the preceding week. Higher scores indicate increased mindfulness. Total scores range from 39–195, with subscale scores ranging from 8-40, or 7-35 in the case of the Non-Reactivity facet. This scale displayed high internal consistency overall (α = .92) and for each facet: Observing (8 items; α = .81), Describing (8 items; α = .86), Acting with Awareness (8 items; α = .91), Non-Judging (8 items; α = .93), and Non-Reactivity (7 items; α = .81).

The *Body Vigilance Scale* (BVS; Schmidt, Lerew, & Trakowski, 1997) is a four-item self-report assessment of one's sensitivity and attentional focus to internal bodily sensations across the previous week. The first three items assess how much attention is paid to bodily sensations and how sensitive one is to changes in bodily sensations from 1 ("not at all") to 10 ("extremely"), as well as the average amount of time spent, per day, scanning for bodily sensations from 0 ("no time") to 100 ("all of the time"). The fourth item asks for ratings of how much attention is paid to 15 different bodily sensations ranging from heart palpitations to feeling detached from the self on a scale of 0 ("none") to 10 ("extreme"). The 15 sensations included in item 4 are the "DSM-IV physical symptoms described for panic attacks" (DSM-IV; American Psychiatric Association, 1994). This scale had high internal consistency (α = .78).

5.3.3.3 Daily Measures

Participants were asked to complete a daily Diary Sheet on each of the 12-day at-home periods. Before completing the dance task, participants were asked to indicate the date and time. After task-completion, participants were asked to rate how easy it was to perform the task, and how they felt performing the task, rated on reverse 7-point Likert scales: ease = 1 ("very easy") to 7 ("very difficult"); feeling = 1 ("very bad") to 7 ("very good"). Participants also provided open comments for each daily session. Finally, included within the daily diary sheet was a 12-item DPD checklist (Hunter, 2014) to measure current state depersonalization-derealization symptoms. 12 symptoms were rated on a scale of 0 ("not at all") to 100 ("extremely"), with total scores ranging from 0 – 1200, and were to be completed both pre- and post-task. On Day 1, this scale has high internal consistency (α = .97).

5.3.4 Dance tasks

We designed two dance-based tasks that either focused on training explicit bodily awareness (Body Awareness [BA]) or implicitly enhancing the salience of bodily signals (Dance Exercise [DE]) (see **Appendix A3** for detailed, standardized instructions of both tasks, and **Figure 5.2** for an example illustration of the two tasks). Both of these tasks are based on the first authors' experience as a dancer and choreographer, and her developing in-studio movement practice aimed at grounding in, and proactively engaging with, the body (de Tord & Brauninger, 2015). In the case of the BA task, this involves principles from body scanning (Fischer, Messner, & Pollatos, 2017) and the use of grounding objects in DDD treatment (Hunter, 2013).

Figure 5.2 Example illustration of what the two dance tasks involve.

Body Awareness (BA) Task **Dance Exercise (DE) Task**

Notes. Example movements included in both the BA and DE tasks. Face has been blurred for anonymity.

Body Awareness (BA): The BA task consists of a warmup (5.60 minutes) and structured dance movement (15.05 minutes), using imagery to guide participants to attend to their body via a set of standardized instructions. The warmup focuses on relaxation and being present in the current time and space. The main task involves guiding a “stress ball” (or comparable object) along the surface of the body and then imagining this same ball traveling both on the surface of and inside the body (**Figure 5.2**). Participants were encouraged to explore different properties of the imagined ball, altering its size, weight and speed whilst travelling across their body and to notice their concomitant sensations in the process. Progressively, participants were then invited to use these sensations to generate their own movements. Throughout the entire task, participants were prompted to try their best to attend to bodily sensations they might be experiencing. Both the warmup and main task are paired with relaxing background music.

Dance Exercise (DE): This task consists of a warmup (4.58 minutes) and learning a short and simple dance phrase (10.33 minutes). The task requires participants to copy a set of pre-specified dance steps that follow the rhythm of a piece of music. The movement elements of the task include stretches, balances and swinging movements that are combined in an increasingly dynamic way (**Figure 5.2**). The task involves learning the five movements (simple, coordinated movements of the arms and legs) included in the movement sequence and then stitching these together in a sequence for a set of eight counts, four counts and two counts. These sets of counts follow the rhythm of the music. The warmup is also paired with a piece of upbeat music playing in the background.

In a follow-up in-person study from a different group of participants (DDD: n=18, age M=35.4, SD=14.1, gender = 72% F, 28% M; Control: n=14, age M=31.2, SD=10.5, gender = 86% F, 14% M) which will be presented in Chapter 6, we collected accelerometer and heart rate data to assess physiological differences across the time course of the two tasks. These data demonstrate that, at least on Day 1 of task performance, the DE task involves both more movement, $t(14) = -3.25$, $p = .006$, $g = 1.18$, and is associated with a higher heart rate, $t(15) = -2.35$, $p = .03$, $g = .80$, than the BA task, with both task differences being large in magnitude.

5.3.5 Analysis

The study was preregistered on OSF (https://osf.io/ymz2c). All data were analyzed using the statistical software *R* (Version 4.1.0; R Core Team, 2021). Missing data for the CDS, MAIA-II, FFMQ, and BVS was found for 0.3%-2.0% of cases. Little's MCAR test was non-significant, χ 2 (5195) = 5329.55, *p* = .094, and therefore we assume the data were missing completely at random. Expectation-maximisation was used to estimate missing data for these four questionnaires. Outliers (*M* +/- 2.5 *SD*s) were identified and winsorized to allow for inclusion in the final analyses. The two groups were compared on demographics and psychometric measures using independent samples *t*-tests and Chi-squared tests. Distribution normality was evaluated with QQ plots and Shapiro-Wilk tests, homogeneity of variance was evaluated with Levene's test, and sphericity was assessed with Mauchly's test. In cases where normality was not satisfied (Shapiro-Wilk test $p < .05$), the analyses were still carried out as all data points fell roughly along the reference line in QQ plots and ANOVA is tolerant to deviations of normality (Chiarotti, 2004). The data did violate homogeneity of variance (Levene's test $p < .05$) in some cases, however, insofar as the sample sizes are relatively equal (*n*=31, *n*=29), ANOVAs should be robust under these circumstances (Chiarotti, 2004). In situations where the assumption of sphericity was violated, degrees of freedom were corrected using Hyunh-Feldt estimates of sphericity. Five, three-way (2 x 2 x 3: Group x Task Type x Time), mixed-model ANOVAs were conducted on CDS total scores, CDS factor 1 Anomalous Bodily Experience (CDS-ABE) scores, MAIA-II mean scores, FFMQ total scores, and BVS total scores with η_p^2 as the measure of effect size.

Finally, within-subject repeated measures correlations were computed for the collapsed total sample as well as for the DDD group separately to assess associations between DD (CDS and CDS-ABE) and interoceptive awareness (MAIA-II) and mindfulness (FFMQ). We also examined the association between level of compliance, measured by the number of days the task was performed overall, and mean CDS scores across the study period. Secondary analyses included an examination of daily state dissociative symptom scores (12-item DPD checklist), with mean scores (pre-task, post-task) computed for days 1-12. Exploratory analyses investigated associations between CDS, FFMQ, and MAIA-II subscales. All analyses were two-tailed ($\alpha < .05$) except the exploratory analyses which used a lower threshold for significance ($\alpha < .01$).

5.4 Results

5.4.1 Patient and control group demographics

As can be seen in **Table 5.1**, participants with DDD experienced moderate anxiety, moderately severe depression, and elevated obsessive-compulsive symptoms, whereas controls experienced mild anxiety, mild depression, and reduced obsessive-compulsive symptoms. At baseline, DDD participants scored significantly above the clinical cut-off for DDD (Sierra & Berrios, 2000), on depersonalization-derealization (CDS; $g = 3.86$), and on the 'anomalous bodily experience' subscale (CDS-ABE; $g = 3.31$). The DDD group also exhibited significantly lower interoceptive awareness (MAIA-II; $g = 0.79$), mindfulness (FFMQ; $g = 1.16$), and dance experience (Gold-DSI; $g = 0.61$) than the control group. Although not significant, a trend towards a reduced ability to vividly visualize scenarios in the DDD group was also present ($g = 0.48$), and body vigilance did not differ between the two groups ($g = 0.34$). In sum, at baseline, participants with DDD show more severe DD symptoms as well as reduced interoceptive awareness and mindfulness, as compared to clinically healthy controls. Beyond this, an exploratory correlation between baseline levels of symptom severity (CDS) and dance experience (Gold-DSI) trends towards significance in the total sample, $r(58) = -.26$, $p = .046$ [95% CI = -.48, -.005] (though nonsignificant in the DDD group, $r(29) = .01$, $p = .94$ [95% CI = -.34, .37], and control group, $r(27) = .05$, $p = .78$ [95% CI = -.32, .41], separately), suggesting that higher levels of dance experience may be associated with lower levels of symptom severity.

Table 5.1 Demographic characteristics and research variables as a function of group, and descriptive statistics [*M* and (*SD*)] as a function of Study time point, Task, and Group (DDD *n*=31, Control *n*=29).

Variable	DDD group (*n* = 31) *M* (*SD*)	Control group (*n* = 29) *M* (*SD*)	*t* (*df*)	*p*	*g*
GAD-7	12 (5.64)	3.90 (2.77)	-7.13 (44.30)	<.001***	1.78
PHQ-9	14.1 (7.95)	4.46 (3.73)	-6.03 (43.51)	<.001***	1.51
OCI-R	19.8 (12.9)	11.5 (6.45)	-3.19 (44.76)	.003**	.80
VVIQ	45.13 (14.9)	51.72 (11.9)	1.90 (56.66)	.06	.48
Gold-DSI	102 (23.9)	116 (21.5)	2.42 (57.92)	.019*	.61
CDS	151.99 (38.9)	28.7 (20.9)	-15.41 (46.58)	<.001***	3.86
CDS-ABE	47.73 (16.0)	6.03 (6.72)	-13.31 (40.81)	<.001***	3.31
FFMQ	107 (19.4)	129 (18.1)	4.64 (58)	<.001***	1.16
MAIA-II	2.30 (0.64)	2.78 (0.55)	3.14 (57.63)	.003**	.79
BVS	22.5 (8.34)	19.9 (6.48)	-1.33 (56.15)	.19	.34

		DDD			**Controls**		
	Task	**Week 1**	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**
CDS	**BA**	145 (45.4)	137 (46.7)	128 (45.3)	27.5 (21.0)	25.9 (21.2)	24.5 (23.6)
	DE	143 (44.5)	128 (47.9)	123 (46.8)	28.8 (26.3)	26.1 (24.1)	22.4 (23.0)
CDS-ABE	**BA**	44.2 (17.2)	42.2 (16.8)	39.1 (17.1)	6.03 (7.10)	6.62 (7.11)	6.71 (7.75)
	DE	44.8 (17.5)	38.6 (18.1)	37.2 (16.7)	6.81 (8.20)	6.60 (7.79)	6.10 (8.02)
MAIA-II	**BA**	2.34 (.64)	2.40 (.54)	2.42 (.60)	2.93 (.50)	3.05 (.53)	3.13 (.50)
	DE	2.32 (.67)	2.39 (.65)	2.40 (.65)	2.83 (.52)	2.96 (.53)	3.06 (.52)
FFMQ	**BA**	112 (19.3)	112 (20.1)	115 (21.6)	130 (18.3)	135 (17.5)	138 (16.3)
	DE	106 (22.8)	113 (21.6)	116 (22.2)	132 (16.9)	133 (17.5)	135 (17.2)
BVS	**BA**	22.4 (7.92)	21.2 (8.07)	21.4 (7.77)	19.9 (5.92)	21.8 (6.68)	21.2 (6.67)
	DE	21.7 (8.07)	21.6 (7.79)	20.8 (8.03)	20.3 (6.41)	20.3 (6.07)	21.8 (7.53)

Notes. GAD-7 = *Generalized Anxiety Disorder-7*; PHQ-9 = *Patient Health Questionnaire-9*; OCI-R = *Obsessive Compulsive Inventory Revised*; VVIQ = *Vividness of Visual Imagery* Questionnaire; Gold-DSI = *Goldsmiths Dance Sophistication Index*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalisation Scale – Anomalous Bodily Experience*; FFMQ = *Five Facet Mindfulness Questionnaire*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness*; BVS = *Body Vigilance Scale*. *p<.05; **p<.01; ***p<.001

5.4.2 ANOVAS

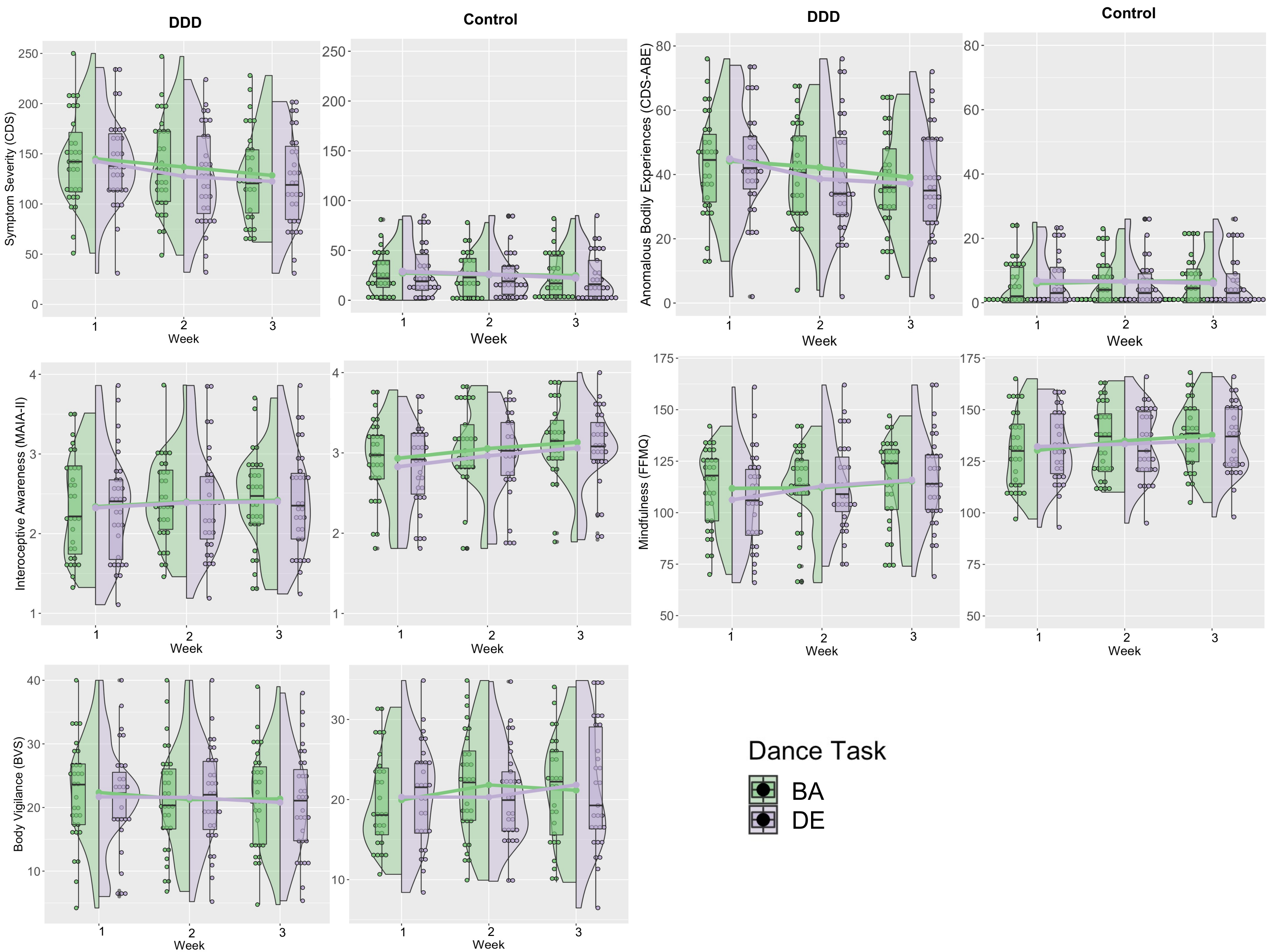
CDS

A three-way mixed ANOVA was performed to evaluate the effects of group (DDD, Controls), task type (BA, DE), and time (Week 1, Week 2, Week 3) on depersonalization-derealization symptom severity (CDS, **Figure 5.3**). There were significant main effects of group, $F(1, 56) = 157.45$, $p < .001$, $\eta_p^2 = 0.74$), and time, $F(1.58, 88.64) = 20.98$, $p < .001$, $\eta_p^2 = 0.27$, on CDS scores, and a significant group x time interaction, $F(1.58, 88.64) = 7.14$, $p = .003$, $\eta_p^2 = 0.11$. There was no significant main effect of task type, $F(1, 56) = 1.20$, $p = .23$, $\eta_p^2 = .02$, or any interactions between task type x group, $F(1, 56) = 0.85$, $p = .36$, $\eta_p^2 = .02$, or task type x time, $F(2, 112) = 0.61$, $p = .54$, $\eta_p^2 = .01$), and no three-way interaction, $F(2, 112) = 0.53$, $p = .59$, $\eta_p^2 = .01$.

Post hoc tests on the significant group x time interaction collapsed across tasks in the two groups, with a Bonferroni adjustment, reveal a significant main effect of time in the DDD group, $F(1.56, 45.2) = 18.32$, $p < .001$, $\eta_p^2 = .39$, but not in the control group, $F(1.51, 40.7) = 3.69$, $p = .045$, $\eta_p^2 = .12$. Further, pairwise comparisons with a Bonferroni adjustment reveal that CDS scores were significantly different in the DDD group from Week 1 – Week 2 ($p <.001$, $d = .25$) and Week 1 – Week 3 ($p <.001$, $d = .41$), but not from Week 2 – Week 3 ($p = .11$, $d = .15$). As expected, there were no significant effects of time on CDS scores in the control group (Week 1 – Week 2: $p = 1.00$, $d = .09$; Week 1 – Week 3: $p = .97$, $d = .20$; Week 2 – Week 3: $p = 1.00$, $d = .11$).

An exploratory *post hoc* test with a Bonferroni adjustment in the DDD group alone, looking at the effect of time across the two dance tasks, reveals that this time effect was present with both the BA, $F(2, 58) = 9.39$, $p < .001$, $\eta_p^2 = .25$, and DE tasks, $F(1.61, 48.4) = 11.8$, $p < .001$, $\eta_p^2 = .28$, with comparably large effect sizes. These results suggest that both the BA and DE tasks reduced the severity of depersonalization-derealization symptoms over time, in the DDD group.

Figure 5.3 Research variables (symptom severity, interoceptive awareness, mindfulness, body vigilance) measured from Week 1 – Week 3.



Notes. BA = *Body Awareness task*; DE = *Dance Exercise task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness – II*; FFMQ = *Five Facet Mindfulness Questionnaire*; BVS = *Body Vigilance Scale.*

CDS-ABE

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on anomalous bodily experience scores (CDS-ABE, **Figure 5.3**). Given the focus of the tasks and our central research questions within this study, we were particularly interested in examining the impact of the tasks on anomalous bodily experiences. Similar to the CDS total scores, there were significant main effects of group, $F(1, 56) = 128.22$, $p < .001$, $\eta_p^2 = .70$, and time, $F(1.82, 101.74) = 9.87$, $p < .001$, $\eta_p^2 = .15$, and a significant group x time interaction, $F(1.82, 101.74) = 8.83$, $p < .001$, $\eta_p^2 = .14$. There was no significant main effect of task type, $F(1, 56) = 0.41$, $p = .52$, $\eta_p^2 = .01$, or any additional interactions (task type x group: $F(1, 56) = 0.34$, $p = .56$, $\eta_p^2 = .01$; task type x time: $F(2, 112) = 1.48$, $p = .23$, $\eta_p^2 = .03$; group x task type x time: $F(2, 112) = 0.58$, $p = .56$, $\eta_p^2 = .01$).

As observed with the CDS, Bonferroni-corrected *post hoc* tests on the group x time interaction, collapsed across tasks in the two groups, revealed a significant main effect of time in the DDD group, $F(2, 58) = 11.82$, $p < .001$, $\eta_p^2 = .29$, but not in the control group, $F(2, 54) = .053$, $p = .95$, $\eta_p^2 = .002$. Pairwise comparisons with a Bonferroni adjustment reveal that CDS-ABE scores were significantly different among participants with DDD in the first week (Week 1 – Week 2: $p = .002$, $d = .24$) and Week 1 – Week 3 ($p <.001$, $d = .37$), but not the second week of the task (Week 2 – Week 3: $p = .49$, $d = .13$). There were non-significant results in all cases in the control group (Week 1 – Week 2: $p = 1.00$, $d = .03$; Week 1 – Week 3: $p = 1.00$, $d = .001$; Week 2 – Week 3: $p = 1.00$, $d = .03$).

An exploratory *post hoc* test with a Bonferroni adjustment in the DDD group alone, looking at the effect of time across the two tasks, reveals that this time effect was present with both the BA, $F(2, 58) = 6.49$, $p = .003$, $\eta_p^2 = .18$, and DE tasks, $F(1.62, 48.6) = 8.08$, $p = .002$, $\eta_p^2 = .21$, with similar effect sizes. Thus, both tasks appear to reduce the severity of anomalous bodily experiences over time in the DDD group.

MAIA-II

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on interoceptive awareness (MAIA-II average scores, **Figure 5.3**). There were significant main effects of group, $F(1, 56) = 25.77$, $p < .001$, $\eta_p^2 = .32$, reflecting lower MAIA-II scores in the DDD group than in the control group, and time, $F(2, 112) = 8.61$, $p < .001$, $\eta_p^2 = .13$. There was no significant main effect of task type, $F(1, 56) = 1.89$, $p = .17$, $\eta_p^2 = .03$, or any interactions (group x task type: $F(1, 56) = 0.36$, $p = .55$, $\eta_p^2 = .01$; group x time: $F(1.81, 101.45) = 1.09$, $p = .34$, $\eta_p^2 = .02$; task type x time: $F(2, 112) = 0.25$, $p = .78$, $\eta_p^2 = .02$; group x task type x time: $F(2, 112) = 0.44$, $p = .65$, $\eta_p^2 = .01$).

Bonferroni-corrected *post hoc* tests on the significant main effect of time revealed significant differences in MAIA-II scores in the total sample from Week 1 – Week 2 ($p = .041$, $d = .33$) and Week 1 – Week 3 ($p <.001$, $d = .54$), but not from Week 2 – Week 3 ($p = .34$, $d = .21$). Exploratory *post hoc* tests looking at the two groups separately revealed significant effects of time in the control group from Week 1 – Week 3 ($p = .003$, $d = .43$), but not from Week 1 – Week 2 ($p = .28$, $d = .25$) or Week 2 – Week 3 ($p = 1.00$, $d = .17$). In the DDD group, no significant effects of time were seen (Week 1 – Week 2: $p = 1.00$, $d = .11$; Week 1 – Week 3: $p = .88$, $d = .12$; Week 2 – Week 3: $p = 1.00$, $d = .02$).

Further exploratory *post hoc* tests with a Bonferroni adjustment in the control group alone, looking at the effect of time across the two tasks, reveals that this time effect was present with both the BA, $F(2, 54) = 4.62$, $p = .014$, $\eta_p^2 = .15$, and DE tasks, $F(2, 56) = 8.40$, $p = .001$, $\eta_p^2 = .23$, with similar effect sizes. Thus, both dance tasks appear to improve interoceptive awareness over time in the control group.

FFMQ

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on mindfulness (FFMQ total scores, **Figure 5.3**). There were significant main effects of group, $F(1, 56) = 22.78$, $p < .001$, $\eta_p^2 = .29$, and time, $F(1.62, 90.68) = 14.19$, $p <$

.001, η_p^2 = .20, on FFMQ scores, but there was no significant main effect of task type, *F*(1, 56) = .49, *p* = .49, η_p^2 = .01.

Following up the simple main effect of time in each group separately, FFMQ scores improved over the complete two weeks of the task (Week 1 – Week 3) in both the DDD group (*p* < .001, *d* = .30) and the control group (*p* = .026, *d* = .32), but not separately from Week 1 – Week 2 (DDD: *p* = .48, *d* = .17; Control: *p* = 1.00, *d* = .17) or Week 2 – Week 3 (DDD: *p* = .48, *d* = .14; Control: *p* = 1.00, *d* = .16) for both groups.

Additionally, we observed a significant group x task type x time interaction, *F*(1.88, 105.52) = 3.46, *p* = .038, η_p^2 = .06. This three-way interaction is driven by differential effects of the two tasks on mindfulness in the two groups. Bonferroni-corrected *post hoc* tests reveal that across Week 1 – Week 3, FFMQ scores in the DDD group increased significantly after performing the DE task, *F*(1.51, 45.4) = 8.76, *p* = .002, η_p^2 = .23, but not the BA task, *F*(1.66, 48.1) = 1.93, *p* = .16, η_p^2 = .06. Interestingly, we observed the opposite effect in healthy controls: across Week 1 – Week 3, FFMQ scores increased after performing the BA task, *F*(2, 54) = 6.66, *p* = .003, η_p^2 = .20, but not the DE task, F(1.61, 45.0) = 1.66, *p* = .21, η_p^2 = .06. In sum, the DE task looks to have increased mindfulness in the DDD group whereas the BA task increased mindfulness in the control group.

BVS

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on body vigilance (BVS scores, **Figure 5.3**). There was a significant two-way interaction between group and time, *F*(2, 112) = 3.30, *p* = .041, η_p^2 = .056, on BVS scores, but no other significant effects (group: *F*(1, 56) = .004, *p* = .95, η_p^2 = .00; time: *F*(2, 112) = .068, *p* = .93, η_p^2 = .001; task type: *F*(1, 56) = .28, *p* = .60, η_p^2 = .005; group x task type: *F*(1, 56) = .02, *p* = .89, η_p^2 = .00; time x task type: *F*(2, 112) = .24, *p* = .79, η_p^2 = .004; group x time x task type: *F*(2, 112) = 2.62, *p* = .078, η_p^2 = .05).

Bonferroni-corrected *post hoc* tests on this group x time interaction collapsed across tasks in the two groups, revealed non-significant main effects of time at each level of group (DDD: $F(1.58, 45.8) = 1.99$, $p = .16$, $\eta_p^2 = .06$; Control: $F(2, 54) = 1.49$, $p = .23$, $\eta_p^2 = .05$). It appears that the group x time interaction is simply driven by a general upward trend in BVS scores from Week 1 – Week 3 in the control group paired with a general downward trend in the DDD group. These results suggest that neither task significantly altered levels of body vigilance across the study period, in both the DDD and control groups.

5.4.3 Change Score Correlations

The next series of analyses examined whether task-related changes in the different research variables covaried in order to determine the extent to which the different observed effects are inter-related.

CDS, CDS-ABE & MAIA-II

When examining the relationship between the CDS and MAIA-II from Week 1 – Week 3 (**Figure 5.4**) of performing the BA task, a significant negative association was found in the total sample, $r_{rm}(117) = -.21$, $p = .02$ [95% CI = -.38, -.03], and in the DDD group alone, $r_{rm}(60) = -.27$, $p = .034$ [95% CI = -.49, .02]. In contrast, there was no relationship between the CDS-ABE and MAIA-II scores (total sample, BA task: $r_{rm}(117) = -.12$, $p = .19$ [95% CI = -.30, .06]; DDD: $r_{rm}(60) = -.21$, $p = .10$ [95% CI = -.44, .05]).

When performing the DE task, we observed a significant negative association between the CDS and MAIA-II in the total sample, $r_{rm}(119) = -.20$, $p = .03$ [95% CI = -.37, -.02], and in the DDD group alone, $r_{rm}(61) = -.29$, $p = .022$ [95% CI = -.50, -.04]. The same holds for the relationship between CDS-ABE and MAIA-II scores (total sample: $r_{rm}(119) = -.23$, $p = .01$ [95% CI = -.40, -.05]; DDD: $r_{rm}(61) = -.29$, $p = .02$ [95% CI = -.50, -.04]).

In sum, the reduction in overall DD symptoms in response to both tasks is linked to increasing interoceptive awareness, but the more specific reductions in anomalous bodily experiences in the DDD group are associated with corresponding increases in interoceptive awareness with the DE task only.

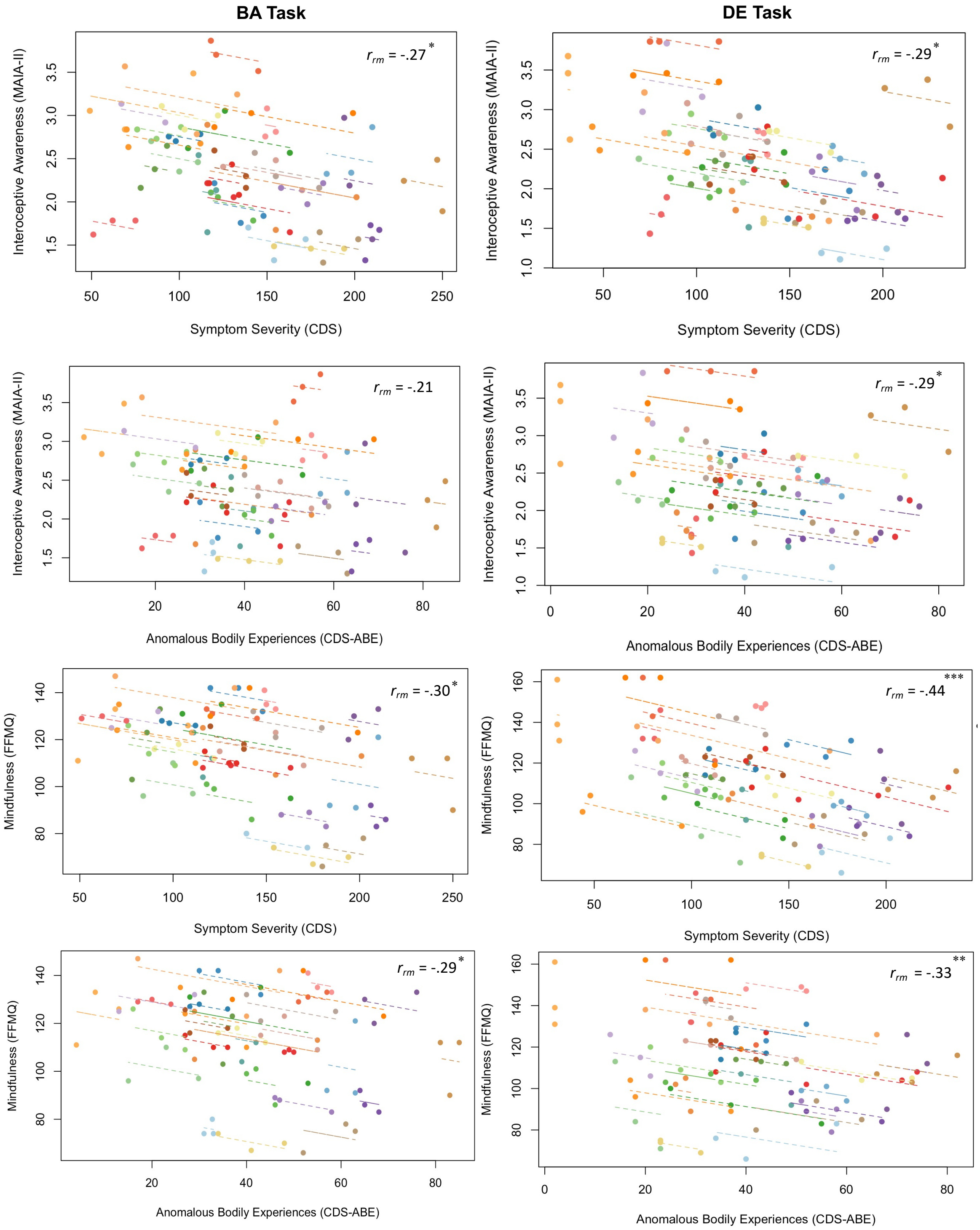
CDS, CDS-ABE & FFMQ

With the BA task, we observed a significant negative association between the CDS and FFMQ from Week 1 – Week 3 (**Figure 5.4**) in the total sample, $r_{rm}(117) = -.25$, $p = .005$ [95% CI = -.42, -.08], and in the DDD group alone, $r_{rm}(60) = -.30$, $p = .02$ [95% CI = -.52, -.05]. Similarly, the CDS-ABE and FFMQ tended to be negatively related in the total sample, $r_{rm}(117) = -.18$, $p = .052$ [95% CI = -.35, .003] and were significantly negatively associated in the DDD group alone, $r_{rm}(60) = -.29$, $p = .02$ [95% CI = -.51, -.04].

With the DE task, the CDS and FFMQ were negatively correlated in the total sample, $r_{rm}(119) = -.35$, $p < .001$ [95% CI = -.50, -.18], and in the DDD group alone, $r_{rm}(61) = -.44$, $p < .001$ [95% CI = -.62, -.21], as were the CDS-ABE and FFMQ (total sample: $r_{rm}(119) = -.32$, $p < .001$ [95% CI = -.47, -.14]; DDD: $r_{rm}(61) = -.33$, $p = .01$ [95% CI = -.54, -.09]).

In sum, with both tasks, as mindfulness increased, overall DD symptom severity decreased. Further, reductions in anomalous bodily experiences are also associated with increases in mindfulness for both tasks in the DDD group.

Figure 5.4 Repeated measures correlations between changes in symptom severity and interoceptive awareness and symptom severity and mindfulness from Time 1 – Time 3 in participants with DDD (*n*=31).



Notes. BA = *Body Awareness task*; DE = *Dance Exercise task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness – II*; FFMQ = *Five Facet Mindfulness Questionnaire,* *p<.05, **p<.01, ***p<.001.

MAIA-II & FFMQ

Exploring the relationship between the MAIA-II and FFMQ when performing both tasks, significant positive associations were found in all cases: BA controls: $r_{rm}(56) = 0.62$, p < .001 [95% CI = .42, .76]; BA DDD: $r_{rm}(60) = 0.38$, p = 0.002 [95% CI = .14, .58]; DE controls: $r_{rm}(57) = 0.42$, p < .001 [95% CI = .18, .62]; DE DDD: $r_{rm}(61) = 0.31$, p = 0.013 [95% CI = .07, .52]. These results suggest that improvements in mindfulness are linked to improvements in interoceptive awareness, and vice versa, in both participant groups.

5.4.4 Diary Sheet Data

Secondary analyses of daily state DD symptom scores (12-item DPD checklist) mirror, overall, the change in weekly scores. A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time (pre, post) on mean daily state DD scores (day 1-12 mean pre-task score, days 1-12 mean post-task score). Significant main effects of group, $F(1, 58) = 112.18$, $p < .001$, $\eta_p^2 = .66$, and time, $F(1, 58) = 23.83$, $p < .001$, $\eta_p^2 = .29$, on mean state DD scores were found, as well as significant interactions between group x time, $F(1, 58) = 29.64$, $p < .001$, $\eta_p^2 = .34$, and task type x time, $F(1, 58) = 14.15$, $p < .001$, $\eta_p^2 = .20$. There was no interaction between group x task type, $F(1, 58) = .51$, $p = .48$, $\eta_p^2 = .01$, and no three-way interaction, $F(1, 58) = .42$, $p = .52$, $\eta_p^2 = .01$.

Bonferroni-corrected *post hoc* tests on the group x time interaction collapsed across the tasks in the two groups revealed a significant main effect of time in the DDD group, $F(1, 30) = 39.2$, $p < .001$, $\eta_p^2 = .57$, but not in the control group, $F(1, 28) = .27$, $p = .61$, $\eta_p^2 = .01$, indicating that across time, daily state DD scores decreased in the DDD group.

Across the two-week period (see **Figure 5.5**), both tasks reduced daily state DD symptoms in the DDD group, BA: $F(1, 30) = 34.9$, $p < .001$, $\eta_p^2 = .54$; DE: $F(1, 30) = 35.1$, $p < .001$, $\eta_p^2 = .54$, with no significant changes seen in the control group, BA: $F(1, 28) = 2.61$, $p = .12$, $\eta_p^2 = .09$; DE: $F(1, 28) = 3.47$, $p = .07$, $\eta_p^2 = .11$. These results suggest that both the

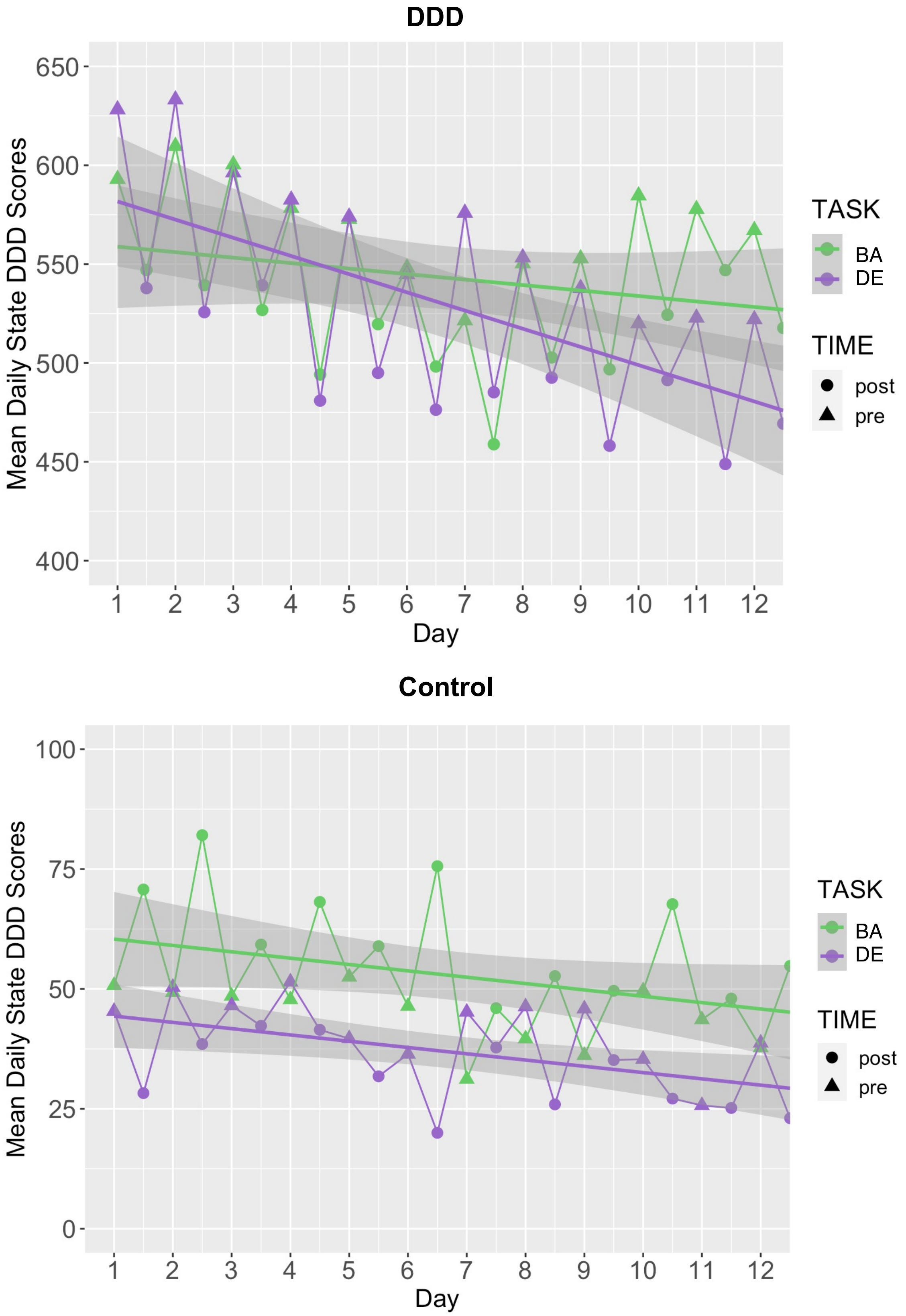
BA and DE tasks reduce the severity of daily state DD symptoms in the DDD group across the two-week study period.

When examining the relationship between state (12-item DPD checklist; pre-task mean, post-task mean) and trait (CDS; Week 1 scores, Week 3 scores) DDD, we see a positive correlation: $r_{rm}(177) = .21$, $p = .004$ [95% CI = .07, .35]. This demonstrates an association between state and trait DD such that as state depersonalization-derealization scores decrease, trait depersonalization-derealization scores also decrease.

Part of the daily diary sheet asked participants to indicate how easy it was to perform the task and how they felt performing the task. In the DDD group, on average, the BA task was rated as more difficult to perform than the DE task, $t(59.77) = 2.33$, $p = .02$, $g = .59$ (BA: M=2.91, SD=1.11; DE: M=2.23, SD=1.18), but there was no significant difference in ratings of how participants felt after performing the tasks, $t(59.92) = -.61$, $p = .55$, $g = .16$ (BA: M=4.13, SD=0.98; DE: M=4.29, SD=1.01). The same was seen in the control group, with the BA task rated as more difficult, $t(53.84) = 2.93$, $p = .005$, $g = .78$ (BA: M=2.51, SD=1.03; DE: M=1.78, SD=.84) with no significant difference in ratings of how participants felt after performing the task, $t(53.48) = -.91$, $p = .34$, $g = .25$ (BA: M=4.68, SD=1.28; DE: M=4.97, SD=1.03).

We also examined the level of compliance, measured by number of days the task was performed across each of the two weeks, and mean CDS scores after performing the DE and BA tasks separately, in the DDD group alone. This was non-significant for the DE task, $r(29) = -.003$, $p = .99$ [95% CI = -.36, .35], but trended towards significance when looking at the BA task, $r(29) = -.33$, $p = .07$ [95% CI = -.61, .03]. The reduction in dissociative symptoms does not appear to depend on how diligently people with DDD performed dance exercise, but better compliance with performing body awareness tended to more strongly improve mean CDS symptom scores. Taken together, the diary results suggest the BA task is more difficult to perform than the DE task. Importantly, any differences seen between the two tasks imply that the reduction in CDS scores was not merely a result of time passing between measurement points (**Figure 5.5**).

Figure 5.5 Pre- and post-task mean daily state DDD scores from Days 1 – 12



Notes. BA = *Body Awareness task*; DE = *Dance Exercise task*; Mean Daily State DDD Scores = *12 Item DPD Checklist*

5.4.5 Exploratory Analyses

Exploratory analyses investigated associations between CDS, FFMQ, and MAIA-II subscales. Exploratory analyses used a lower threshold for significance ($\alpha < .01$). From Week 1 – Week 3 while performing the DE task, significant negative correlations are seen between the CDS and FFMQ-O (Observing; $r_{rm} = -.31$, $p = .01$, [95% CI = -.52, -.06]) and FFMQ-AA (Acting with Awareness; $r_{rm} = -.40$, $p = .001$ [95% CI = -.59, -.16]) facets, with a trend towards significance with the FFMQ-NJ facet (Non-Judging; $r_{rm} = -.27$, $p = .03$ [95% CI = -.49, -.02]). When examining these three facets after performing the BA task, nonsignificant results were found in all cases (Observing: $r_{rm} = -.07$, $p = .59$ [95% CI = -.32, -.19]; Acting with Awareness: $r_{rm} = -.06$, $p = .66$ [95% CI = -.31, .20]; Non-Judging: $r_{rm} = -.10$, $p = .44$ [95% CI = -.35, .16]).

This is in direct contrast to the results seen after performing the BA task: significant negative correlations are found with the CDS and FFMQ-D (Describing; $r_{rm} = -.38$, $p = .002$ [95% CI = -.58, -.14]), and a trend towards significance with the FFMQ-NR facet (Non-reacting; $r_{rm} = -.27$, $p = .03$ [95% CI = -.49, -.02]). In examining these two facets after performing the DE task, nonsignificant results were observed (Describing: $r_{rm} = -.16$, $p = .20$ [95% CI = -.40, .09]; Non-Reacting: $r_{rm} = -.01$, $p = .91$ [95% CI = -.27, -.24]).

In exploring the MAIA-II subscales, a significant negative correlation was seen from Week 1 – Week 3 when performing the DE task only when looking at the MAIA-T (Trusting) subscale ($r_{\text{rm}} = -.36$, $p = .004$ [95% CI = -.56, -.12]) (BA task results: $r_{\text{rm}} = -.15$, $p = .24$ [95% CI = -.39, .11]). However, when looking at the MAIA-BL (Body Listening) subscale, this was significant after the BA task ($r_{\text{rm}} = -.35$, $p = .005$ [95% CI = -.56, -.11]) and only trends towards significance after the DE task ($r_{\text{rm}} = -.29$, $p = .02$ [95% CI = -.51, -.04]). No other significant correlations were found (ps > .06).

Further, we ran exploratory ANOVAs examining the other three subscales of the CDS (emotional numbing [CDS-EN], anomalous subjective recall [CDS-ASR], alienation from surroundings [CDS-AfS], **Table 5.2**).

Table 5.2 Descriptive statistics [*M* and (*SD*)] for exploratory research variables as a function of Study time point, Task Type, and Group (DDD: *n*=31, Control: *n*=29).

		DDD			Control		
Variable	**Task**	**Week 1**	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**
CDS-EN	**BA**	26.2 (11.1)	24.7 (11.3)	24.1 (11.7)	5.52 (5.50)	4.76 (6.16)	3.71 (5.95)
	DE	24.9 (12.0)	22.8 (11.7)	22.2 (12.7)	5.90 (6.40)	4.65 (6.15)	3.78 (4.90)
CDS-ASR	**BA**	25.6 (10.1)	24.3 (10.5)	22.9 (9.20)	7.41 (5.24)	6.59 (4.89)	5.79 (4.82)
	DE	24.7 (9.93)	22.8 (8.77)	22.00 (8.28)	7.09 (5.42)	7.19 (5.42)	5.40 (5.58)
CDS-AfS	**BA**	30.2 (6.76)	28.1 (8.23)	26.5 (7.89)	4.83 (4.48)	4.97 (4.34)	4.36 (4.26)
	DE	29.5 (7.54)	26.8 (9.44)	25.7 (8.21)	4.79 (4.24)	4.55 (4.12)	4.34 (4.29)

Notes. BA = Body Awareness task; DE = Dance Exercise task; CDS-EN = *Cambridge Depersonalization Scale – Emotional Numbing*; CDS-ASR = *Cambridge Depersonalisation Scale – Anomalous Subjective Recall*; CDS-AfS = *Cambridge Depersonalisation Scale – Alienation from Surroundings.*

In evaluating the effects of group, task type, and time on CDS-EN scores, there was a significant main effect of group $F(1, 56) = 84.41$, $p < .001$, $\eta_p^2 = .60$, and time, $F(1.84, 102.81) = 8.40$, $p < .001$, $\eta_p^2 = .13$, on CDS-EN scores, but no main effect of task type, $F(1, 56) = 1.27$, $p = .26$, $\eta_p^2 = .03$, or any interactions (task type x group: $F(1, 56) = 1.41$, $p = .24$, $\eta_p^2 = .03$; group x time: $F(1.84, 102.81) = .15$, $p = .85$, $\eta_p^2 = .003$; task type x time: $F(2, 112) = .03$, $p = .97$, $\eta_p^2 = .001$; group x task type x time: $F(2, 112) = 0.05$, $p = .96$, $\eta_p^2 = .001$). Bonferroni-corrected *post hoc* tests on the significant main effect of time revealed significant differences in CDS-EN scores in the total sample from Week 1 – Week 3 ($p < .001$, $d = .52$), and Week 1 – Week 2 ($p = .018$, $d = .37$), but not from Week 2 – Week 3 ($p = .73$, $d = .15$). Exploratory *post hoc* tests looking at the two groups separately revealed significant effects of time in the DDD group from Week 1 – Week 3 ($p = .02$, $d = .26$), but not from Week 1 – Week 2 ($p = .38$, $d = .18$) or Week 2 – Week 3 ($p = 1.00$, $d = .09$). In the control group, no significant effects of time were seen (Week 1 – Week 2: $p = 1.00$, $d = .17$; Week 1 – Week 3: $p = .28$, $d = .36$; Week 2 – Week 3: $p = 1.00$, $d = .18$). These results suggest that, across the two-week study period, the severity of emotional numbing decreased, with no differences seen between the two dance tasks.

A mixed-ANOVA on CDS-ASR scores revealed significant main effects of group, $F(1, 56) = 94.07$, $p < .001$, $\eta_p^2 = .63$, and time, $F(1.58, 88.24) = 11.63$, $p < .001$, $\eta_p^2 = .16$, but no main effect of task type, $F(1, 56) = 1.12$, $p = .30$, $\eta_p^2 = .02$, or any interactions (task type x group: $F(1, 56) = .89$, $p = .35$, $\eta_p^2 = .02$; group x time: $F(1.58, 88.24) = .91$, $p = .39$, $\eta_p^2 = .02$; task type x time: $F(2, 112) = .02$, $p = .98$, $\eta_p^2 < .001$; group x task type x time: $F(2, 112) = .54$, $p = .59$, $\eta_p^2 = .01$). Bonferroni-corrected *post hoc* tests on the significant main effect of time revealed significant differences in CDS-ASR scores in the total sample from Week 1 – Week 3 ($p < .001$, $d = .61$), but not from Week 2 – Week 3 ($p = .04$, $d = .33$) or Week 1 – Week 2 ($p = .10$, $d = .28$) separately. Exploratory *post hoc* tests looking at the two groups separately revealed significant effects of time in the DDD group from Week 1 – Week 3 ($p < .001$, $d = .32$), but not from Week 1 – Week 2 ($p = .26$, $d = .10$) or Week 2 – Week 3 ($p = 1.00$, $d = .21$). In the control group, no significant effects of time were seen (Week 1 – Week 2: $p = 1.00$, $d = .00$; Week 1 – Week 3: $p = .31$, $d = .20$; Week 2 – Week 3: $p = 1.00$, $d = .20$). As above, these results suggest that, across the two-week study period, the severity of anomalous subjective recall decreased, with no differences seen between the two dance tasks.

Looking at CDS-AfS scores, a mixed-ANOVA revealed significant main effects of group $F(1, 56) = 245.30$, $p < .001$, $\eta_p^2 = .81$, and time, $F(1.79, 100.15) = 13.23$, $p < .001$, $\eta_p^2 = .19$, on CDS-AfS scores, as well as a significant group x time interaction, $F(1.79, 100.15) = 6.90$, $p = .002$, $\eta_p^2 = .11$. There was no main effect of task type, $F(1, 56) = 1.43$, $p = .24$, $\eta_p^2 = .03$, or any additional interactions (task type x group: $F(1, 56) = .47$, $p = .50$, $\eta_p^2 = .01$; task type x time: $F(2, 112) = .57$, $p = .57$, $\eta_p^2 = .01$; group x task type x time: $F(2, 112) = 0.06$, $p = .95$ $\eta_p^2 = .001$). Bonferroni-corrected *post hoc* tests on the group x time interaction, collapsed across tasks in the two groups, revealed a significant main effect of time in the DDD group, $F(2, 58) = 14.6$, $p < .001$, $\eta_p^2 = .34$, but not in the control group, $F(2, 54) = .93$, $p = .40$, $\eta_p^2 = .03$. Pairwise comparisons with a Bonferroni adjustment reveal that CDS-AfS scores were significantly different among participants with DDD in the first week (Week 1 – Week 2: $p = .002$, $d = .37$) and Week 1 – Week 3 ($p <.001$, $d = .53$), but not the second week of the task

(Week 2 – Week 3: p = .32, d = .12). There were non-significant results in all cases in the control group (Week 1 – Week 2: p = 1.00, d = .00; Week 1 – Week 3: p = 1.00, d = .25; Week 2 – Week 3: p = 1.00, d = .25). These results suggest that, across the two-week study period, the severity of alienation from surroundings decreased in the DDD group, with no differences seen between the two dance tasks.

An exploratory *post hoc* analysis with a Bonferroni adjustment in the DDD group alone, looking at the effect of time across the two tasks, reveals that this time effect was present with both the BA, $F(1.55, 44.9) = 9.38$, $p = .001$, $\eta_p^2 = .25$, and DE task, $F(2, 60) = 10.3$, $p < .001$, $\eta_p^2 = .26$, with comparable effect sizes. Thus, both tasks appear to have reduced the severity of alienation from surroundings over time in the DDD group.

5.4.6 Qualitative comments

Finally, we explored the qualitative, open comments provided by the DDD group throughout the study process. The comments highlight individual participants' preference for either the BA or the DE task. Whereas some participants with DDD found both tasks equally effective ("In different ways, [both tasks] encourage me to think about my physical body,") many participants felt strong inclinations to one task over the other. Participants with DDD in particular reported that the DE task helped them to become more aware of their bodies: "… I did notice quite consistently that after I had done it, I did have less feelings of numbness. I definitely felt more attuned to my body"; "Overall, [I] have noticed that the movements and exercise in general makes me feel a bit more grounded and more in control, less unreal." Comments were also made regarding the task breaking the "constant worrying thoughts" accompanying DDD, since the task required concentration and learning a dance phrase.

Other DDD participants preferred the BA task (" It grounds me and I feel every part of my body," and " I feel the connection coming back"). This was reported as exciting. One participant reported that even just the warmup for the BA task "really helps… the first time when we did it over Zoom, I did feel really bad before, but the moment we started the warmup I felt so much better." A number of participants with DDD also reported enjoying a combination of the two tasks: the warmup of the BA task and the main sequence of the DE task. On the whole, more participants with DDD reported experiencing benefits from the DE task, yet benefits of the BA task should not be discounted. Overall, individual differences in these open comments were striking and show the importance of tailoring tasks to the specific needs and symptoms experienced by each person with this condition.

5.5 Discussion

In this study we developed two dance-based tasks with the aim of reducing bodily detachment in DDD: one task to promote explicit bodily awareness (BA) and the other to implicitly enhance the salience of bodily signals (DE). We then tested whether these tasks could reduce symptom severity and improve interoception and mindfulness in a group of people with DDD compared to healthy controls.

Firstly, we show that both tasks reduced symptom severity in those with DDD, including anomalous bodily experiences, over a two-week period. As expected, the healthy control group exhibited a floor effect with no changes in DD symptoms, due to already low baseline scores. Though both tasks were effective in reducing symptom severity in the DDD group, the DE task was perceived to be less difficult and relied less on daily performance. Interestingly, only the DE task increased mindfulness in the DDD group, while only the BA task increased mindfulness in controls. Interoceptive awareness did not significantly improve in the DDD group after performing either task, but it did improve in controls. Repeated measures correlations revealed that reductions in DD symptom severity are tied to improvements in mindfulness and interoceptive awareness in the DDD group. Together, these results point to the efficacy of dance in reducing DD symptoms in this disorder whilst improving a sense of body awareness.

The two tasks impacted mindfulness differently in both groups. In those with DDD, dance exercise appears to enhance mindfulness and awareness of bodily sensations without explicitly asking participants to do so. Performing a simple sequence of movements does not require participants to explicitly focus on their bodily sensations but may actually require participants to shift attention away from these sensations in order to accurately reproduce the dance movements. Our study is not the first to report that shifting attention in this way can support wellbeing. A similar effect was found in a study on the benefits of drawing for emotional regulation (Drake & Winner, 2012). Drawing-to-distract (drawing something unrelated to one's feelings after watching a sad movie) proved to be the more effective intervention to counter the negative emotions elicited by the movie. In our study, dance exercise may fulfil a similar function, where people with DDD shift their attention from the experience of DDD whilst at the same time increasing bodily sensations. In contrast, body awareness may be a more challenging experience for those with DDD because it instructs participant to explicitly focus on their bodily experiences. The BA task thus promotes the individual's ability to verbalize and articulate bodily experiences and sensations. In other words, both tasks appear to address specific components of mindfulness in DDD.

In healthy controls, the improvement in mindfulness seen after the body awareness task aligns with the existing literature on mindfulness interventions and body scanning wherein participation in these types of interventions leads to an improvement in body awareness (Gibson, 2019; Fischer, Messner, & Pollatos, 2017). In healthy controls, explicitly paying attention to the body indeed encourages the development of a mindful awareness of the body. Our findings suggests that mindfulness in participants with DDD can be more effectively enhanced by boosting the salience of bodily signals, whereas an explicit attention to the body through body awareness improves mindfulness in controls.

In the DDD group, mean interoceptive awareness (MAIA-II) did not significantly improve after performing either task. However, reductions in overall DD symptom severity were still associated with corresponding improvements in interoceptive awareness, suggesting a role for interoceptive processing in the attenuation of DD symptoms. Further explorations of the subscales of the MAIA-II and their relationships to DD symptoms suggest that the two tasks influence distinct aspects of interoceptive awareness: dance exercise appears to encourage a sense of trust and comfort within the body, whereas body awareness promotes a specific type of paying attention to the body. DMT thus allows for the tailoring of tasks to specifically address components of interoceptive awareness, that are also dissociable in the MAIA-II.

In controls, interoceptive awareness did improve after both the dance exercise and body awareness tasks. Given that people with DDD may continuously try to attempt to experience their bodies, engaging with their potential lack of bodily experiences, it is perhaps not surprising that we see larger effects in the realm of interoception in controls who may not consciously attempt to engage with their body in the same way on a day-to-day basis. Improved interoceptive awareness in the control group, in particular after dance exercise, aligns with a putative feedback loop of physical activity and interoceptive processing (Wallman-Jones, Perakakis, Tsakiris, & Schmidt 2021). These results indicate that, overall, these dance tasks are effective tools to enhance both mindfulness and interoceptive awareness in the general population and further implies that these two processes are linked.

In line with our hypotheses, both tasks reduced DD symptoms, yet the two tasks appear to influence different features of mindfulness and interoception and show clear group differences that cannot be explained by the non-specific influence of time, primarily reflecting how physically demanding they are, as dance exercise involves more movement and an increased heart rate relative to body awareness. Additionally, the diary data shows state DD symptoms for those with DDD improve after performing the session, continuously over the time course of the two weeks, most especially with the dance exercise task. Interestingly, in the control group, the body awareness task seemed to induce some dissociative symptoms. Conceivably, the BA task invites bodily experiences from a 3rd rather than 1st person perspective in some participants (Petkova, Khoshnevis, & Ehrsson, 2011). Both diary data and difficulty ratings suggest that overall, the BA task was more challenging to perform and may require a greater length of practice, as compared to the DE task, despite being less physically demanding.

5.6 Study limitations

Our lack of a no-intervention control group means that our findings could be potentially explained by mere spontaneous symptom improvements, regression to the mean, or other therapeutic interventions, including medications or talk therapy, over time. However, the observed task differences imply that the reductions in symptoms are indeed linked to performing the two dance tasks, rather than simply time passing or individuals with DDD working with someone who cares about their condition.

Moreover, all participant sessions were conducted both online and individually, rather than in-person and in a group environment which is most common to DMT ("What does a dance/movement therapy session look like?", 2015), though this excludes a possible role of the social influences on symptom improvements.

Another important limitation within this research is that all measures included were self-report due to the ethical requirement that the study was conducted fully online during the COVID-19 pandemic. As such, it remains to be seen whether the perceived improvement of interoceptive awareness translates to actual interoceptive accuracy (Garfinkel et al., 2015). It is important and necessary that research using DMT and body-based interventions work towards the regular inclusion of more contemporary cognitive neuroscience research and physiological methods for rigorously assessing embodiment and interoception (Millman, Terhune, Hunter, & Orgs, 2020). It is also important that future research includes follow-up measures to get a gauge on whether or not these reductions in depersonalization-derealization symptoms remain in the long term. Alongside this, it would be useful to note if individuals with DDD actually continue to perform one or both of these tasks, or another type of body-based intervention, in their own time after study completion.

5.7 Conclusions

We conclude that dance provides a potentially effective and bespoke tool to reduce dissociative symptoms in DDD, as it allows us to address deficits in mindfulness and interoception in this population. Our findings suggest that dancing can influence different components of both mindfulness and interoception and highlight the usefulness and specificity of dance or creative movement as an intervention for improving body awareness. In this way, dance allows for the development of interventions that *generate* bodily experiences rather than reflect on their disruption, as is the case with talking therapy (Marx, Benecke, & Gumz, 2017). Importantly, this research included a clinical population that is still widely underrecognized, underdiagnosed, and undertreated, but comprises a significant portion of the population (Yang, Millman, David & Hunter, 2022). The continued development of more disorder- or symptom-specific movement-based interventions is an important and necessary way forward, and a particularly promising route to target symptoms of dissociation.

6. In-person, structured dance movement therapy for depersonalization-derealization disorder

6.1 Abstract

Depersonalization-derealization disorder (DDD) involves a sense of bodily detachment. Individuals with DDD often report being unable to feel their body, with a lack of awareness of their own sensations. To address these symptoms, we developed two dance tasks to reduce detachment either by training body awareness (BA task) or through dance exercise (DE task). Individuals with DDD (*n*=18) and healthy controls (*n*=14) performed both tasks in a cross-over design. We assessed depersonalization-derealization (DD) symptom severity, interoception across three domains, mindfulness, proprioceptive accuracy, interval timing, and body vigilance before, during and after the tasks. At baseline, DDD participants exhibited significantly higher temporal precision but significantly lower interoceptive awareness, mindfulness and visual proprioceptive accuracy compared to controls, though no significant differences between the two groups were found with regards to interoceptive accuracy or interoceptive sensibility. Both dance tasks reduced the severity of DD symptoms, overall and anomalous bodily experiences, in the DDD group. Particular within-subject correlations showed that reductions in symptoms were associated with task-specific (BA) improvements in mindfulness. Objective measures of task performance solidify physiological task differences, with the DE task leading to a higher average heart rate and the generation of more body movements than the BA task. These results provide further support for dance/movement as an efficacious tool to reduce symptoms in DDD, with the ability to be tailored to address specific components of a mindful engagement with the body.

6.2 Introduction

Here, we report an in-person variant of the study presented in Chapter 5 that deploys dance as a tool to develop a greater awareness of one's body in people with DDD and a control group of clinically healthy individuals. Expanding on the previous study, additional measures were incorporated into this in-person variant, moving beyond self-report to include behavioural measures of interoceptive accuracy, proprioceptive accuracy, interval timing, and physiological measures of the two dance/movement tasks. The incorporation of these more implicit physiological and behavioural measures helps to provide more control to current DMT research and allows for a better understanding of how these types of tasks may work to target symptom reduction (Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020). These types of measures are potentially less biased and more robust than self-report measures of symptom severity. Given the suggested links between DDD and deficits in interoceptive processing and the representation of bodily signals (Sedeno et al., 2014; Schulz & Vogele, 2015), we were interested in conducting a more comprehensive assessment of interoception (Suksasilp & Garfinkel, 2022), examining it as a multifaceted variable that encompasses dimensions of awareness, accuracy, and sensibility (Garfinkel et al., 2015).

Proprioception, or how one senses their body and its positioning and movement in space, can tell us the degree to which an individual represents and experiences their body as a whole (Jola, Davis, & Haggard, 2011). Alongside interoception, proprioception is another key area of bodily processing that helps to establish the sense of self (Ciaunica et al., 2022). The relationship between interoception and proprioception (Chen et al., 2011; Vaitl, 1996), and the previously identified links between dance and heightened proprioceptive accuracy (Jola, Davis, & Haggard, 2011), meant this was another variable of interest within this clinical population.

The dance tasks developed for this research work with the physical body in very different ways. Though both involve using the body as a whole, the level and type of physical effort and activity should vary with the two tasks. Given the current lack of physiological measures in research exploring dance/movement therapies, it was important to include these here with an aim towards providing more scientific grounding to current dance/movement research whilst generating a better understanding of how and why these two specific dance tasks may work (Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020). Within this study, it was important to confirm the expected physiological differences between the two tasks, providing evidence that they do, in fact, involve different levels of body movement and result in differential physiological signals within the body. To achieve this, we recorded heart rate and acceleration using Empatica E4 wrist sensors (Empatica, 2015), worn throughout task performance. Both of these signals were used as measures of physical activity for the dance tasks. Further, as previously described by Simeon (2004), some individuals with DDD may experience either consistently high or low states of arousal. Incorporating a measure of heart rate, which includes a baseline heart rate that may be representative of a person's fitness level, can also help us to determine if there is a relationship between symptom change within the two tasks and general fitness, or arousal, levels.

Finally, DDD can include temporal disintegration or distortions in the experience of time (Sierra & Berrios, 2001; Simeon, Hwu, & Knutelska, 2007), manifesting as durations being experienced faster, slower, or as if time isn't moving at all. It has also been suggested that a combination of both interoceptive and emotional states leads to the experience of time (Pollatos, Laubrock, & Wittmann, 2014) with direct links being made between physiological processes and the perception of time (Craig, 2009; Herbert & Pollatos, 2011), both relying on the insular cortex, a key area involved in interoception. These proposed links between time perception and interoception, alongside the symptom profile seen in DDD, suggests this is another important area to explore within this research.

Consistent with Chapter 5, the same two dance tasks were used in this study with the body awareness (BA) task aiming to direct an explicit attention towards the body, and the dance exercise (DE) task aiming to implicitly boost bodily signals. Again, we were interested in determining, in the context of DDD, if it may be more effective to explicitly focus on bodily sensations, or to implicitly enhance the salience of bodily signals through aerobic exercise. This study was run on an individual basis to control for any potential social influences on treatment effectiveness.

We hypothesize that the clinically healthy control group will exhibit superior interoception, proprioception, mindfulness, and temporal precision as compared to the DDD group at baseline, with these differences remaining post-intervention. Depersonalization-derealization (DD) symptoms will decrease in the DDD group, and interoceptive awareness, accuracy and sensibility, mindfulness, proprioceptive accuracy, and temporal precision will improve in both the DDD group and control group after the dance tasks. The dance tasks will exhibit physiological differences, seen with the acceleration and heart rate measures. More specifically, the DE task will involve the generation of more body movements and lead to a higher heart rate, compared to the BA task, across task performance. We predict that both dance tasks will reduce bodily detachment in DDD but may do so by affecting different components of bodily awareness. More specifically, if an explicit attention to bodily sensations is helpful, including lower levels of movement and a reduced heart rate, then we would expect the body awareness (BA) task to decrease DD symptoms, including anomalous bodily experiences, whilst improving interoceptive awareness, accuracy, and sensibility, mindfulness, proprioceptive accuracy, and temporal precision. However, if an implicit awareness of the body via increasing the salience of bodily signals, through the generation of more body movements and elevated heart rate, is helpful, then we would expect the dance exercise (DE) task to do the same. Moreover, we expect that reductions in DD symptoms will scale with improvements in mindfulness, interoceptive accuracy, awareness, and sensibility, proprioceptive accuracy, and temporal precision. Finally, daily state depersonalization scores will decrease across the two weeks, and this will be positively associated with a decrease in trait depersonalization scores.

6.3 Materials and Methods

6.3.1 Participants

Participants with DDD were recruited from an internal database of patients at the Depersonalization Research Unit at King's College London. Only patients who had previously expressed a willingness to participate in subsequent research were contacted. Among 73 participants who were initially contacted, 51 (70%) responded, with 48 (94%) of those 51 responders expressing an initial interest in this research. Participants with DDD were also recruited through advertisements posted on thedepersonalisationclinic.com, an independent specialist clinic for the assessment and treatment of DDD, and the UK DDD charity (*Unreal*) website (https://www.unrealuk.org/), as well as in the DDD support group (unrealuk.org) email list. Clinically healthy controls were recruited through advertisements and posts at Goldsmiths, University of London. All interested participants were given an information sheet to provide them with a clear understanding of the study before being contacted for a phone screening to assess eligibility. All eligible participants provided informed consent in accordance with the Declaration of Helsinki and Goldsmiths, University of London research ethics committee ethical approval. All participants received £40 for completion of both phases of the study.

Participants from both groups were included if they met the following criteria: aged 18-70; currently residing in London, UK or with access to the city of London; no previous or current head injury; no severe drug or alcohol use; no neurological disorder; and no severe physical impairment affecting motor performance. To qualify for the DDD group, all participants were required to meet DSM-5 (300.6) diagnostic criteria (American Psychiatric Association, 2013) for current DDD including: chronic or recurrent episodes of depersonalization and derealization; awareness that their symptoms are a subjective experience; the symptoms cause distress and/or impairment to their functioning; and the symptoms are not better explained by another disorder or substance use. Individuals with DDD were also required to have no self-reported comorbid current diagnosis of schizophrenia, other psychosis spectrum disorder, or PTSD. To qualify for the control group, all participants were required to not meet DSM-5 diagnostic criteria for DDD and have no other self-reported current clinical psychiatric diagnoses. These criteria were assessed as part of a structured phone screening interview, designed with a clinician with expertise on DDD (see **Appendix A2**). Based on this screening process, one individual coming forward with DDD was excluded due to differential diagnosis and the presence of PTSD, and six controls were excluded due to the presence of other psychiatric disorders.

The same as with the online study described in Chapter 5, an effect size was generated from a previous study examining changes in body image among depressed adult outpatients in response to a DMT treatment (Pylvanainen, & Lappalainen, 2018). Their effect size for difference between pre- and post-DMT treatment for the sum of questions asked on the body image assessment ("How do you perceive your body and its appearance?") was d=0.73. Using this effect size estimate, we performed an *a priori* sample size estimation (two-tailed α=0.05, power=0.90, 1:1 group ratio), which yielded a required sample size of 22 participants in each group. To account for attrition and potential outliers, we aimed to include a minimum of 30 participants per group. Given the impact of COVID-19, this study was paused for over a year, which led to the loss of data from seven (4 DDD, 3 controls) participants whose participation was interrupted, alongside additional delays in restarting the study, resulting in a lower sample size than the *a priori* targets. We recruited a total of 24 participants with DDD and 18 healthy, demographically matched controls. Six participants in the DDD group and four controls dropped out at various points across the study period.

The final sample of participants who completed all sessions comprised 18 individuals with DDD and 14 controls. All participants with DDD experienced symptoms chronically, on an everyday basis. Participants with DDD and controls were well-matched on demographic variables (see **Table 6.1**) including age, gender, employment status, education, physical activity, and current therapy. Individuals with DDD reported more frequently to be on medication including antidepressants (venlafaxine [1], mirtazapine [1], undisclosed [4]), mood stabilizers (1), SSRIs (escitalopram [4]), and unspecified (2). However, the two groups didn't significantly differ with regard to being currently enrolled in therapy, although this was numerically more frequent in the DDD group (CBT [4], general talk therapy [3], and unspecified [3]; controls: psychotherapy [1], counselling [1], and CBT [1]).

Table 6.1 Demographic characteristics as a function of Group

Variable	DDD (*n* = 18)	Control (*n* = 14)			
	M (*SD*)	*M* (*SD*)	*t* (*df*)	*p*	*g*
Age	35.4 (14.1)	31.2 (10.5)	-.96 (29.97)	.35	.32
	% (*n*)	**% (*n*)**	***χ2***	***p***	***Φ***
Education (% attended university)	72 (13)	100 (14)	2.74	.10	.29
Employment (% employed)	67 (12)	43 (6)	.98	.32	.18
Gender (% female)	72 (13)	86 (12)	.24	.63	.09
Medication (% on current medication)	50 (9)	0 (0)	7.42	.006**	.49
Therapy (% in current therapy)	56 (10)	21 (3)	2.52	.11	.29
Physical activity (% 3x/week or more)	50 (9)	71 (10)	.74	.39	.15

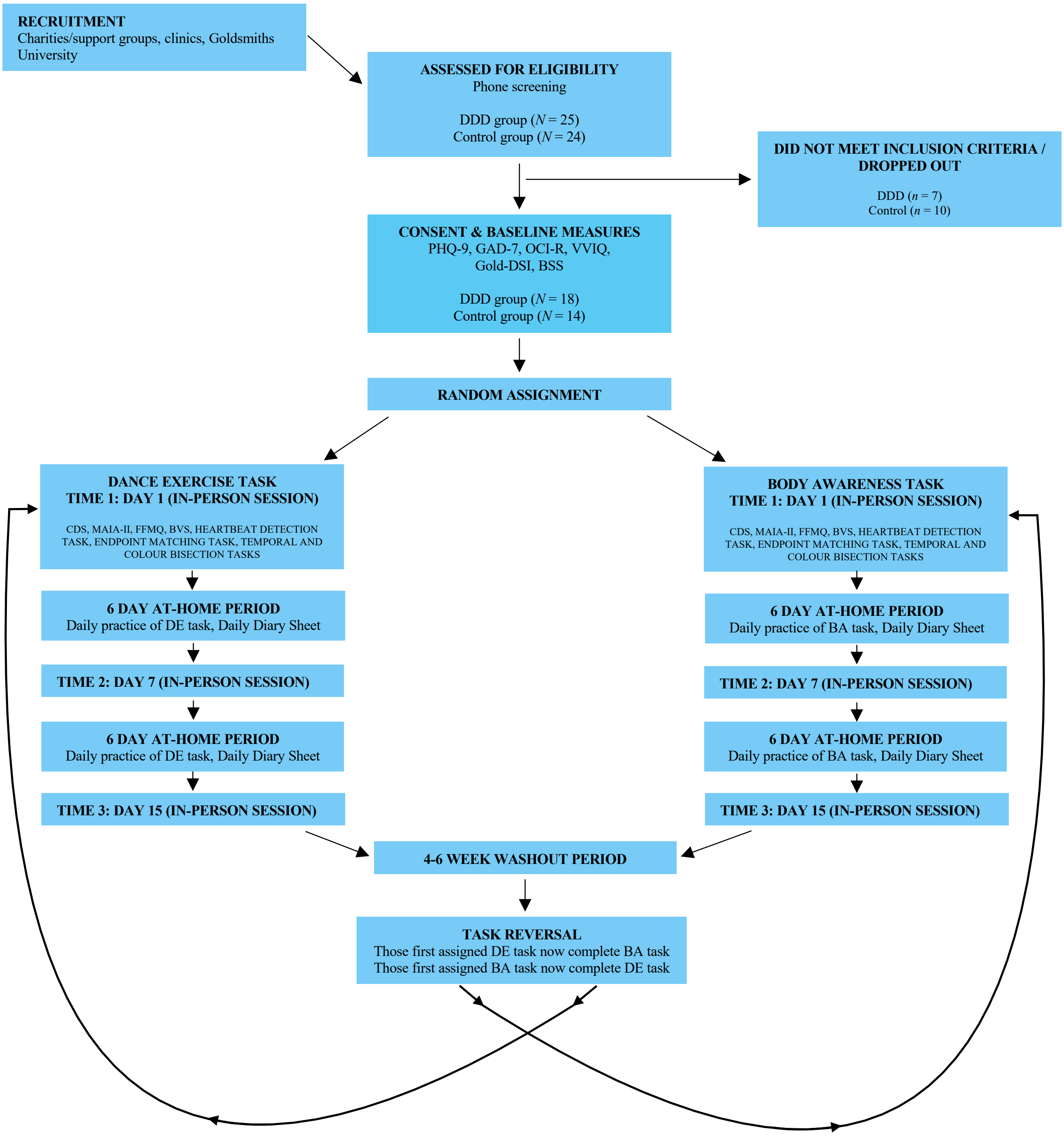
*$p < .05$; **$p<.01$; ***$p < .001$.

6.3.2 Design and procedure

The design was the same as the online study in Chapter 5, a crossover and counterbalanced mixed design in which all participants completed both tasks (BA and DE, see **Figure 6.1**) with order counterbalanced across participants.

Participants were taught one of the two tasks (BA or DE) in the first in-person session, and then asked to perform the task at home once per day across a period of six days. For both tasks, participants were provided with audio recordings of the warmup and task itself to follow along with as they were performing the task at home on their own. Subsequently, after the second in-person session, participants continued to perform the task once per day across a second six-day period. A washout period of four to eight weeks (or longer, due to the impact of COVID-19) separated the two tasks to minimize the risk of carry-over effects. After the washout period, participants were instructed in how to perform the other task and the same procedure was repeated.

Figure 6.1 Flow chart of study design



Notes. GAD-7 = *Generalized Anxiety Disorder-7*; PHQ-9 = *Patient Health Questionnaire-9*; OCI-R = *Obsessive Compulsive Inventory Revised*; VVIQ = *Vividness of Visual Imagery* Questionnaire; Gold-DSI = *Goldsmiths Dance Sophistication Index*; CDS = *Cambridge Depersonalization Scale*; FFMQ = *Five Facet Mindfulness Questionnaire*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness*; BVS = *Body Vigilance Scale*.

6.3.3 Measures

Both self-report (questionnaires) and behavioural (interoception, proprioception, interval timing) measures were administered to assess how the two dance/movement tasks effect DD symptoms, as well as cognitive functions hypothesized to relate to DDD symptomatology. The baseline, weekly and daily self-report measures included in this study are the same as those implemented in the online study discussed in Chapter 5. The measures are listed again below, but further information on the specifics of these measures are included in Chapter 5 (p.100-103).

6.3.3.1 Baseline measures

At baseline, prior to any testing and after providing informed consent, all participants completed measures of depression (PHQ-9; Kroenke, Spitzer, & Williams, 2001), anxiety (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006), obsessive-compulsive disorder (OCI-R; Foa, et al., 2002), imagery vividness (VVIQ; Marks, 1973), and dance engagement and experience (Gold-DSI; Rose, Mullensiefen, Lovatt, & Orgs, G., 2020). Within the current sample, these scales all had high internal consistency (PHQ-9: $\alpha = .84$; GAD-7: $\alpha = .85$; OCI-R: $\alpha = .92$; VVIQ: $\alpha = .96$; Gold-DSI: $\alpha = .95$; Gold-DSI body awareness: $\alpha = .91$; Gold-DSI urge to dance: $\alpha = .86$; Gold-DSI social dancing: $\alpha = .91$; Gold-DSI dance training: $\alpha = .84$).

6.3.3.2 Weekly Measures

Self-Report

At three time points across each of the two-week testing periods (Day 1; Time 1, Day 8: Time 2, Day 15: Time 3), participants completed self-report measures of depersonalization-derealization (CDS; Sierra & Berrios, 2000), interoceptive awareness (MAIA-2; Mehling et al., 2018), mindfulness (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), and body vigilance (BVS; Schmidt, Lerew, & Trakowski, 1997). Within the current sample, these scales and subscales all had a high internal consistency (CDS: α = .95; CDS-Anomalous Bodily Experiences [9 items; α = .89]; CDS-Anomalous Subjective Recall [5 items; α = .78]; CDS-Alienation from Surroundings [4 items; α = .88]; CDS-Emotional Numbing [6 items; α = .80]; MAIA-II: α = .93; MAIA-Noticing [4 items; α = .79]; MAIA-Not Distracting [6 items; α = .90]; MAIA-Not Worrying [5 items; α = .76]; MAIA-Attention Regulation [7 items; α = .88]; MAIA-Emotional Awareness [5 items; α = .89]; MAIA-Self-Regulation [4 items; α = .87]; MAIA-Body Listening [3 items; α = .92]; MAIA-Trusting [3 items; α = .95]; BVS: α = .83; FFMQ: α = .93; FFMQ-Observing [8 items; α = .84]; FFMQ-Describing [8 items; α = .90]; FFMQ-Acting with Awareness [8 items; α = .94]; FFMQ-Non-Judging [8 items; α = .92]; FFMQ-Non-Reactivity [7 items; α = .85]).

Behavioural

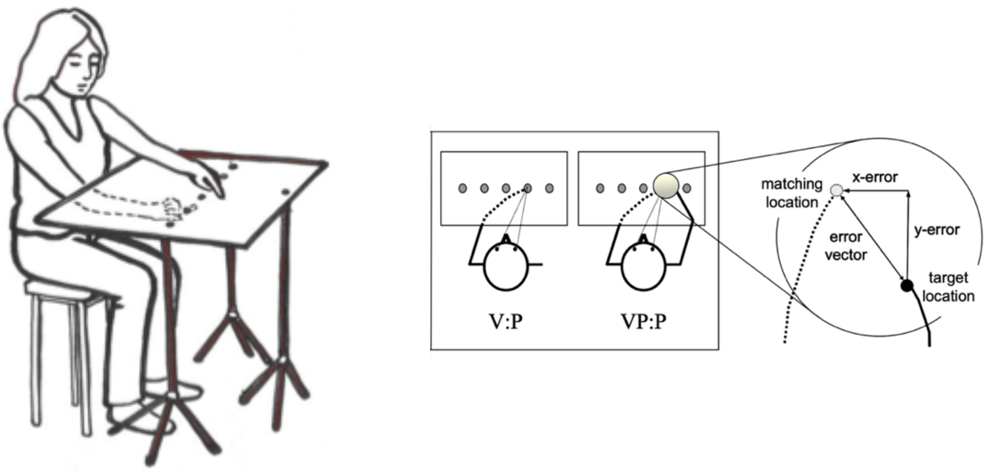
Participants also completed behavioural measures of interoceptive accuracy and interoceptive sensibility, proprioceptive accuracy, and time perception at three time points (Day 1: Time 1, Day 8: Time 2, Day 15: Time 3) across each of the two-week testing periods, in conjunction with the self-report measures.

The *Heartbeat Detection Task* (Schandry, 1981) was included as a measure of interoceptive accuracy and interoceptive sensibility. Participants were seated at a table and asked to sit comfortably with their feet on the floor. They were fitted with a pulse transducer attached to their non-dominant index finger which was used to measure their heartbeat. Participants were instructed to silently monitor how many heartbeats they felt, without physically feeling their pulse, during pre-specified intervals of time and instructed to focus solely on this throughout the task. Intervals (20s, 30s, and 40s) were signified as starting and stopping with the presence of an aural tone (a 1s beep), played at the beginning and end of each interval, and each interval was repeated twice in a random order. Once the interval had ended, participants were asked to report how many heartbeats they had felt and to rate their confidence in their estimate on a visual analogue scale (-30 [not confident at all] to +30

[100% confident]). This confidence rating was used as a measure of interoceptive sensibility. Participants did not receive any feedback on task performance and were also unaware of the lengths of each trial.

The *Endpoint Position Matching Task* (Jola, Davis, & Haggard, 2011) was included as a measure of proprioceptive accuracy: how accurate one is with regard to their body positioning and movement in space. Participants were seated at a table with five circular targets (labeled one through five) measuring 16mm in diameter each, applied on top of the table. Prior to the participant entering the room, a scroll of paper was fitted to the underside of the table with these five targets drawn on. Each target was 20cm apart and all targets were 30cm from the edge of the table on the side in which the participant was sitting (see **Figure 6.2**). The targets were then matched with those on top of the table using N35 Neodymium magnets to ensure alignment of the targets on the top and underside of the table. When running the tasks, participants were seated at a chair facing the middle of the table, directly in front of circle 3. Participants were instructed to hold a pen (Staedtler Noris Fibre-tip) in a tripod grip as close to the tip of the pen as possible, and to match where they thought the corresponding targets were underneath the table by making a dot with the pen. Participants completed the task in two conditions: 1) Visual: participants were instructed to look at the targets labeled 1-5 and match the position of these on the paper applied underneath the table; 2) Visual and proprioceptive: participants were instructed to look at the targets labeled 1-5 and match the position of these on the paper applied underneath the table while also using their other hand to place their index finger on the relevant target on top of the table. Each condition was run with both hands (four different types: Right Hand Visual [RHV], Left Hand Visual [LHV], Right Hand Visual Proprioceptive [RHVP], Left Hand Visual Proprioceptive [LHVP]) in counterbalanced order, with different marker colours. The experimenter called out the target numbers in a random order, repeating each number five times for each condition. In total, participants were asked to make 100 matching attempts: 2 sensory conditions x 2 target hands x 5 target locations x 5 repetitions. Participants did not see the underside of the table or the accuracy of the marks they had made at any point.

Figure 6.2 Diagram of endpoint matching task.

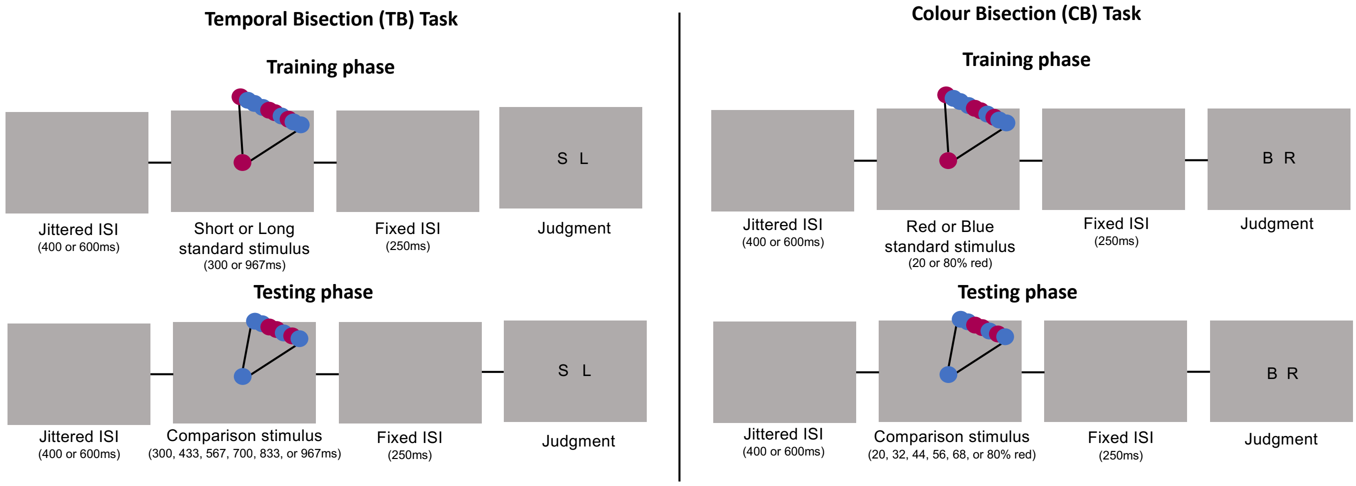


Notes. Figure adapted from Jola, Davis, & Haggard, 2011.

The *Temporal Bisection (TB) Task* (Wearden, 1991; Allan & Gibbon, 1991) was included as a measure of interval timing (**Figure 6.3**). In a training phase, participants were initially trained to discriminate between two anchor intervals (300ms vs. 967ms) demarcated with visual stimuli on a monitor. The visual stimulus presented consisted of a circle (2.25cm) in the center of the monitor that would randomly alternate between red and blue at a frame rate of 60 Hz. In the main experimental phase, participants were presented with same visual stimuli of varying duration (300ms, 433ms, 567ms, 700ms, 833ms, 967ms), in a random order, on a trial-by-trial basis. Participants were instructed to focus on the center of the monitor and to only pay attention to the duration of the stimulus and ignore the colour. Each trial consisted of a 400 or 600ms interstimulus interval (blank screen), the presentation of the circle (visual stimulus) that randomly flickered between blue and red and varied in duration (300ms, 433ms, 567ms, 700ms, 833ms, 967ms), a second interstimulus interval (blank screen; 250ms), and then a two-alternative forced choice judgment prompt with the letters S (presented on the left side of the monitor) and L (presented on the right side of the monitor). Participants were instructed to press the left arrow key if they thought the stimulus was closer to the short (S) anchor and the right arrow key if they thought the stimulus was closer to the long (L) anchor. At each stimulus interval there were six different colour proportion sets, detailed below.

The *Colour Bisection (CB) Task* was included as a control task for the TB Task (Coull, Vidal, Nazarian, & Macar, 2004; Coull, Hwang, Leyton, & Dagher, 2012; Sadibolova, Monaldi, & Terhune, 2022) and follows the same principles as above (**Figure 6.3**). This time, participants were initially trained to discriminate between two anchor colours (mostly-red [80% red] vs. mostly-blue [20% red]) demarcated with randomly fluctuating circles on a monitor. The visual stimulus presented consisted of a circle (2.25cm) in the center of the monitor that would randomly vary in duration. In the main experimental phase, participants were presented with three blocks of the same visual stimuli of varying colour proportions (20%, 32%, 44%, 56%, 68%, or 80% red), in a random order, on a trial-by-trial basis. Participants were instructed to focus on the center of the monitor and to only pay attention to the colour of the stimulus and ignore the duration. As with the TB task, each trial consisted of a 400 or 600ms interstimulus interval (blank screen), the presentation of the circle (visual stimulus) that randomly varied in duration with changes in blue/red colour proportion (20%, 32%, 44%, 56%, 68%, or 80% red), a second interstimulus interval (blank screen; 250ms), and then a two-alternative forced choice judgment prompt, now with the letters B (presented on the left side of the monitor) and R (presented on the right side of the monitor). Participants were instructed to press the left arrow key if they thought the stimulus was mostly blue (B), and the right arrow key if they thought the stimulus was mostly red (R). Each of the six colour stimuli included equal proportions of the stimulus durations presented in the TB task.

Figure 6.3 Temporal and colour bisection tasks.



Notes. Schematic diagram of the temporal and colour bisection tasks. Participants observed a circle flickering between red and blue at 60 Hz. They were instructed to either focus on the duration (Temporal bisection) or the colour (Colour bisection). Each task involved learning a pair of standard stimuli in the training phase (i.e., short [300ms] and long [967ms], mostly red [80% red] and mostly blue [20% red]), followed by the testing phase in which participants judged the comparison stimuli with reference to the learned standards. All trials consisted of a blank screen (ISI of 400 or 600ms), a stimulus, a post-stimulus blank screen (ISI of 250ms), and then the response key mappings. Participants responded by pressing the left and right arrow keys on a computer keyboard.

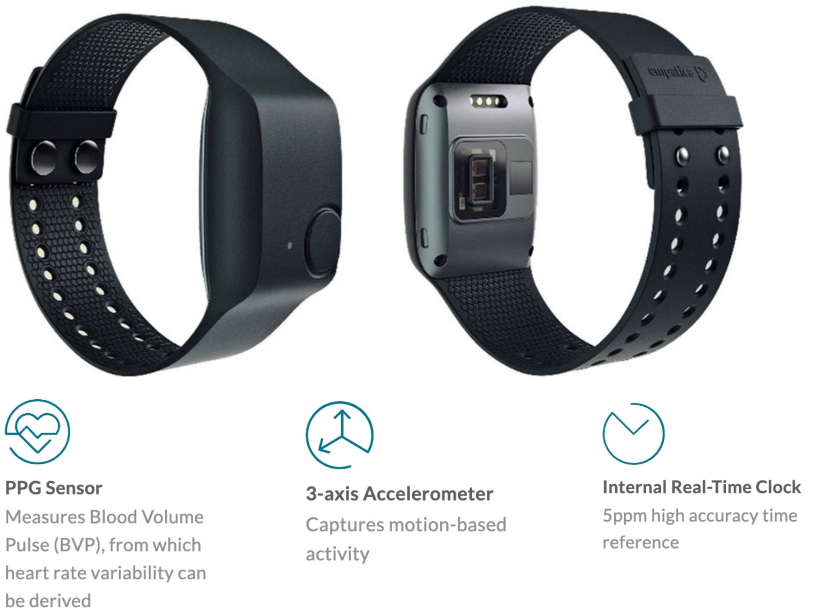
6.3.3.3 Daily Measures

Participants were asked to complete a daily Diary Sheet on each of the 12-day at-home periods. Before completing the dance task, participants were asked to indicate the date and time. After task-completion, participants rated the task difficulty (1 [“very easy”] to 7 [“very difficult”]) and how they felt performing the task (1 [“very bad”] to 7 [“very good”]). Participants were also presented with a space to provide any extra comments about the daily session. Finally, they completed a 12-item DPD checklist (Hunter, 2014) to measure current state depersonalization-derealization symptoms (0 [“not at all”] to 100 [“extremely”]), with total scores ranging from 0 – 1200, and were to be completed both pre- and post-task performance to provide present state ratings. On Day 1, this scale had high internal consistency (α = .96).

6.3.3.4 Empatica E4

Empatica E4 wrist bands (Empatica, 2015, see **Figure 6.4**) were worn by participants to monitor heart rate and to track acceleration in three-dimensional space throughout task completion, while performing the task at home. The E4 includes a 3-axis accelerometer to capture motion-based activity and a photoplethysmography (PPG) sensor to measure blood volume pulse and monitor heart rate. These were worn during this study to get a gauge on the physiological differences between the two dance tasks.

Figure 6.4 Empatica E4 wristband



Notes. Illustration adapted from Empatica, 2015 https://www.empatica.com/en-gb/research/e4/

6.3.4 Dance tasks

The dance/movement tasks included in this study are the same as those in the online study discussed in Chapter 5 and either focused on training explicit bodily awareness (Body Awareness [BA]) or implicitly enhancing the salience of bodily signals (Dance Exercise [DE]). More details of the two tasks can be found in both Chapter 5 (p. 104-105) and **Appendix A3**.

6.3.5 Analysis

The study was preregistered on the open science framework (https://osf.io/xtvs8) and all data were analysed using *R* (Version 4.1.0; R Core Team, 2021). There were no missing data for any psychometric measures except the BVS and MAIA-II (0.5-1.6% of cases).

Little's MCAR test was non-significant, χ^2 (1384) = 6.816, p = 1.000, and therefore we assume the data were missing completely at random. Expectation-maximisation was used to estimate missing data for these two questionnaires. Outliers (M +/- 2.5 SDs) were identified and winsorized (.005%) to allow for inclusion in the final analyses. Due to the impact of COVID-19, as well as technical issues with equipment, some participants had missing data for the behavioural measures including the endpoint matching task, heartbeat detection task, and temporal and colour bisection tasks. Further, 3 individuals with DDD were unable to complete the temporal and colour bisection tasks due to the stimuli affecting their vision. In these cases where a participant was missing a full session for these measures, they have not been estimated and are not included in the analysis of that data. Similarly, any missing days from the Daily Diary Sheet measure are not included in the analyses of this data.

Data from the interval timing (TB) task and its control task (CB) were analyzed by first computing the proportion of long [p(long)] (or red [p(red)]) responses for each stimulus interval (or colour proportion). We then fit a logistic function to p(long) values using maximum likelihood estimation as implemented in the Palamedes toolbox in MATLAB (Prins & Kingdom, 2018) in order to estimate alpha (bisection point; BP) and beta (slope) parameters (guess rates and lapse rates were fixed at 0 and 0.01, respectively). Subsequently, we computed the BP: the duration that is perceived to be equidistant to the short and long anchor intervals, which corresponds to the interval location of the psychometric function corresponding to p(long)=.50, and the Weber fraction (WF): the difference limen ((p(long)=.75 – p(long)=.25)/2) divided by the BP. These two measures, respectively, provide measures of relative perceived duration or temporal bias (larger BP values reflect relative underestimation) and temporal precision (lower WF values reflect superior precision).

In the case of the TB and CB tasks, due to individual psychometric functions not intersecting with one of the necessary values, seven (2%) of the WFs included imaginary numbers and could not be analyzed. However, upon visual inspection, in all cases, the psychometric functions exhibited suitable fit to the data and thus these cases were treated as missing values and missing value estimation was used to estimate the respective values. Beyond this, 29 sessions (8%) displayed bad pdev values (<.05) suggesting poor model fit (Kingdom & Prins, 2016). Upon visual inspection, the psychometric functions approximated the data relatively well and often deviations were minimal or only marginally below the recommended threshold (e.g., .05<pdev<.01). Given the nature of the study and the large number of conditions involved, these data were retained and included in the analyses. Supplementary analyses excluding these cases were conducted and are reported alongside the main analysis. Outliers for BP and WF values within this bisection task data (*M* +/- 2.5 *SD*s) were identified and winsorized (3%) to allow for inclusion in the final analyses.

To calculate interoceptive accuracy, the proportional discrepancy between the perceived and the actual number of heartbeats was calculated as: (counted heartbeats – recorded heartbeats) / recorded heartbeats. This was calculated for each interval and then averaged across the six trials, resulting in an accuracy error index with values closer to 0 reflecting a lower discrepancy and superior interoceptive accuracy (Cioffi et al., 2017). To calculate proprioceptive accuracy, an absolute matching error was calculated in both the visual condition and the visual and proprioceptive condition as the distance (in mm) between the center of the target point and the location of the pen dot made underneath the table and averaged for each target (1-5) across the four conditions (RHV, LHV, RHVP, LHVP). For the overall visual matching error, the RHV and LHV conditions were averaged and for the overall visual proprioceptive error, the RHVP and LHVP conditions were averaged.

Empatica E4 wrist sensors were used to examine and explore physiological differences between the two tasks and across individuals. The heart rate data (average heart rate extracted from the blood volume pulse [BVP] signal), sampled at 1Hz, was extracted for each participant and visually inspected for missing data or an impossibly low or high heart rate. The acceleration data, measuring continuous gravitational force (g) in the range [-2g, 2g], was also extracted for each participant and the magnitude of the acceleration was calculated by taking the square root of the sum of squared x, y, and z values (Vicary, Sperling, von Zimmerman, Richardson, & Orgs, 2017). This left us with a composite measure across these three dimensions and therefore an individual acceleration profile for each participant and both tasks. Larger acceleration values are indicative of an increase in acceleration.

Individuals with DDD and controls were compared on demographics and psychometric measures using independent samples *t*-tests and Chi-squared tests. Distribution normality was evaluated with QQ plots and Shapiro-Wilk tests, homogeneity of variance was evaluated with Levene's test, and sphericity was assessed with Mauchly's test. In cases where normality was not satisfied, the analyses were still carried out as all points fell roughly along the reference line in QQ plots and ANOVA is tolerant to deviations of normality (Chiarotti, 2004), with the exception of Weber Fraction (precision) values, which displayed distribution normality after a log transformation. In situations where the assumption of sphericity was violated, degrees of freedom were corrected using Hyunh-Feldt estimates of sphericity. Nine, three-way (2 x 2 x 3: Group x Task Type x Time) mixed-model ANOVAs were conducted on CDS total scores, CDS Anomalous Bodily Experience (CDS-ABE) scores, MAIA-II mean scores, FFMQ total scores, BVS total scores, interoceptive accuracy scores, interoceptive sensibility scores, and proprioceptive accuracy scores (visual and visual and proprioceptive conditions) with η_p^2 as the measure of effect size. A further 2 x 2 x 2 x 3 (Group x Task Type x Task modality [CB vs. TB] x Time) mixed-model ANOVA was conducted on WF (precision) values. For all ANOVAs, the primary results will be reported followed by Bonferroni-corrected, follow-up *post hoc* tests for any significant main effects or interactions. Beyond this, exploratory *post hoc* tests will also be included to better unpick and get a gauge on any potential task differences.

Within-subject repeated measures correlations were computed for the collapsed total sample as well as for the DDD group separately to assess associations between depersonalization-derealization (CDS and CDS-ABE) and interoceptive awareness (MAIA-II), mindfulness (FFMQ), interoceptive accuracy (mean error rate in heartbeat detection task), proprioceptive accuracy (visual matching error and visual and proprioceptive matching error), and temporal precision (temporal bisection Weber Fraction).

We also examined the association between level of compliance, measured by the number of days the task was performed, and mean CDS scores. Secondary analyses included an examination of daily state dissociative symptom scores (12-item DPD checklist), with mean scores (pre-task, post-task) computed for days 1-12. Exploratory correlational analyses investigated associations between CDS, FFMQ and MAIA-II subscales. Exploratory mixed-model ANOVAs were also run on the three other CDS subscales (Emotional Numbing, Alienation from Surroundings, Anomalous Subjective Recall) and on BP (bisection point) values extracted from the TB and CB tasks. All analyses were two-tailed ($\alpha < .05$) except the exploratory analyses, which used a lower threshold for significance ($\alpha < .01$).

6.4 Results

6.4.1 Patient and control group demographics

As can be seen in **Table 6.2**, both participants with DDD and controls experienced mild anxiety (Spitzer, Kroenke, Williams, & Lowe, 2006), though the DDD group experienced moderate depression (Kroenke, Spitzer, & Williams, 2001) while controls experienced mild depression. At baseline, DDD participants scored significantly higher, and well above the recommended clinical cut-off (Sierra & Berrios, 2000), than controls on the measure of depersonalization-derealization (CDS; g = 2.96), as well as the 'anomalous bodily experience' subscale (CDS-ABE; g = 2.11). In contrast, DDD participants exhibited significantly lower interoceptive awareness (MAIA-II; g = 1.45), mindfulness (FFMQ; g = 1.20), dance experience (Gold-DSI; g = 1.27), and a reduced ability to vividly visualize scenarios (VVIQ; g = .76) than controls. In contrast to these psychometric differences, there were no significant group differences in interoceptive accuracy (g = .31) or interoceptive sensibility (g = .62), though the latter trended towards significance with lower interoceptive sensibility (confidence) ratings present in the DDD group, suggesting a disconnect between these dissociable dimensions of interoception. The two groups did not significantly differ in bodily vigilance (g = .50) or obsessive-compulsive symptoms (g = .49). These results are consistent with the hypotheses that individuals with DDD would show more severe depersonalization-derealization (DD) symptoms as well as reduced interoceptive awareness and mindfulness, as compared to clinically healthy controls, at baseline. The visual condition in our endpoint matching task (proprioceptive accuracy) revealed significant differences between the two groups at baseline, indicating less proprioceptive accuracy in the DDD group as compared to controls (g = .73). Looking at the visual and proprioceptive condition, however, this difference was no longer significant (g = .51). Beyond this, an exploratory correlation between baseline levels of symptom severity (CDS) and dance experience (Gold-DSI) is significant in the total sample, $r(30) = -.46$, $p = .01$ [95% CI = -.70, -.13] (though nonsignificant in the DDD group, $r(16) = .10$, $p = .70$ [95% CI = -.39, .54], and control group, $r(12) = -.29$, $p = .32$ [95% CI = -.71, .29], separately), suggesting that higher levels of dance experience may be associated with lower levels of symptom severity.

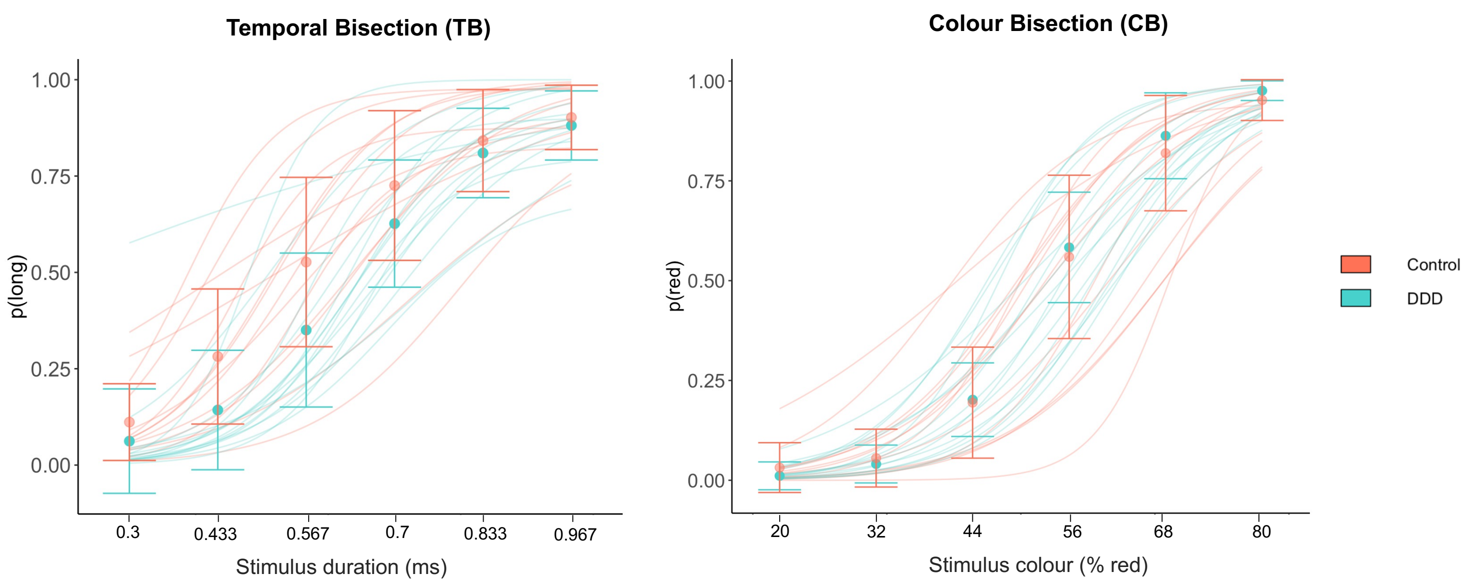
The analyses of the psychophysical data firstly revealed that the two groups significantly differed in temporal precision (TB-WF; g = .79, **Table 6.2** & **Figure 6.5**), with the DDD group, perhaps surprisingly, exhibiting superior temporal precision. By contrast, the two groups did not significantly differ on perceived duration/temporal bias (BP), although the magnitude of the group difference was moderate in size (g = .45), with the DDD group displaying larger values, suggesting a tendency to underestimate temporal intervals. By contrast, there were no significant differences between the groups for WF and BP values in the CB task, with uniformly weak effect sizes (gs<.10). The group difference in temporal precision is potentially an artefact of the DDD group being more motivated to perform well. To test whether this group difference in temporal precision with the TB task was due to the level of difficulty of the task, a 2x2 (group x bisection task) ANOVA was run on overall accuracy (%; how accurate were participants in judging whether the stimulus was long/short or red/blue). This revealed no significant main effects (group: $F(1, 20) = .43$, $p = .52$, η_p^2 = .02; bisection task: $F(1, 20) = 2.35$ $p = .14$, $\eta_p^2 = .11$) or interaction between group x bisection task, $F(1, 20) = .11$, $p = .74$, $\eta_p^2 = .01$, suggesting that the difficulty of the task did not play a role in the observed group difference in TB WF (precision) values.

Table 6.2 Demographic characteristics and research variables as a function of Group (N=32; DDD: *n*=18, control: *n*=14).

Variable	DDD group (*n* = 18) M (*SD*)	Control group (*n* = 14) M (*SD*)	*t* (*df*)	*p*	*g*
GAD-7	9 (4.12)	7.29 (4.83)	-1.06 (22.60)	.30	.38
PHQ-9	10.6 (4.76)	6.36 (5.76)	-2.20 (25.06)	0.04*	.79
OCI-R	19.3 (13.0)	13.5 (9.32)	-1.46 (29.84)	.15	.49
VVIQ	40.4 (13.0)	52 (16.9)	2.11 (23.84)	.045*	.76
Gold-DSI	104 (28.2)	135 (16.2)	3.96 (27.87)	<.001***	1.27
CDS	142 (41.3)	39.5 (20.1)	-9.21 (25.81)	<.001***	2.96
CDS-ABE	40.3 (17.0)	9.93 (8.66)	-6.58 (26.41)	<.001***	2.11
FFMQ	102 (19.3)	127 (21.4)	3.43 (26.52)	.002**	1.20
MAIA-II	2.06 (0.54)	2.99 (0.72)	4.05 (23.56)	<.001***	1.45
BVS	19.2 (8.41)	23.3 (7.22)	1.46 (28.93)	.16	.50
IAcc	0.26 (0.15)	0.31 (0.17)	0.77 (25.55)	.45	.31
ISens	-4.61 (15.5)	4.74 (13.9)	1.76 (28.76)	.088	.62
VisAcc	35.1 (19.0)	23.5 (10.1)	-2.11 (23.45)	.045*	.73
VisPropAcc	33.4 (23.9)	23.8 (7.86)	-1.52 (18.62)	.15	.51
TB-WF (log)	.74 (.13)	.85 (.14)	2.18 (26.74)	.039*	.79
TB-BP	.62 (.14)	.56 (.12)	-1.26 (28)	.22	.45
CB-WF (log)	.88 (.10)	.88 (.16)	.004 (21.20)	1.00	.00
CB-BP	.58 (.08)	.59 (.13)	0.25 (21.23)	.80	.09

Notes. GAD-7 = *Generalized Anxiety Disorder-7*; PHQ-9 = *Patient Health Questionnaire-9*; OCI-R = *Obsessive Compulsive Inventory Revised* ; VVIQ = *Vividness of Visual Imagery* Questionnaire; Gold-DSI = *Goldsmiths Dance Sophistication Index*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalisation Scale – Anomalous Bodily Experience*; FFMQ = *Five Facet Mindfulness Questionnaire*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness*; BVS = *Body Vigilance Scale*; IAcc = *Heartbeat Detection Task Interoceptive Accuracy*; ISens = *Heartbeat Detection Task Interoceptive Sensibility*; VisAcc = *Visual Condition of Endpoint Matching Task*; VisPropAcc = *Visual & Proprioceptive Condition of Endpoint Matching Task*; TB-WF (log) = *Weber Fraction of Temporal Bisection Task*; CB-WF (log) = *Weber Fraction of Colour Bisection Task*; TB-BP = *Bisection Point of Temporal Bisection Task*; CB-BP = *Bisection Point of Colour Bisection Task.* *$p < .05$; **$p<.01$; ***$p < .001$.

Figure 6.5. Baseline (time 1) individual psychometric functions and mean performance levels in the temporal bisection (TB) and colour bisection (CB) tasks as a function of group. Markers denote mean (+/- SE) proportion of long (TB) and red (CB) responses at each stimulus level. Continuous lines denote individual psychometric functions.



Notes. p(long) = proportion of long responses at each stimulus interval; p(red) = proportion of red responses at each colour interval.

6.4.2 Self-Report

CDS

A three-way mixed ANOVA was performed to evaluate the effects of group (DDD, Controls), task type (BA, DE), and time (Week 1, Week 2, Week 3) on depersonalization-derealization (DD) symptom severity (CDS; **Figure 6.6**). There were significant main effects of group, $F(1, 30) = 57.95$, $p < .001$, $\eta_p^2 = .66$, reflecting higher CDS scores in the DDD group, and time, $F(2, 60) = 7.607$, $p = .001$, $\eta_p^2 = .20$, on CDS scores. There was no main effect of task type, $F(1, 30) = 1.28$, $p = .27$, $\eta_p^2 = .04$, or any interactions between group x task type, $F(1, 30) = .02$, $p = .90$, $\eta_p^2 = .001$, group x time, $F(2, 60) = 2.05$, $p = .14$, $\eta_p^2 = .06$, task type x time, $F(2, 60) = .80$, $p = .46$, $\eta_p^2 = .03$, or group x task type x time, $F(2, 60) = 3.04$, $p = .55$, $\eta_p^2 = .09$.

Follow-up *post hoc* tests, with a Bonferroni adjustment, revealed significant declines in the severity of depersonalization-derealization symptoms in the total sample from Week 1 – Week 2 ($p = .042$, $d = .45$) and Week 1 – Week 3 ($p < .001$, $d = .68$), but not from Week 2

– Week 3 (p = .59, d = .23). These results suggest that the severity of depersonalization-derealization symptoms decreased across the two-week study period, more specifically from Week 1 – Week 2 and Week 1 – Week 3, with no apparent differences between the two dance tasks. Exploratory *post hoc* tests to examine symptom change in each group separately, since we are independently interested in both participant groups, revealed significant effects of time in the DDD group from Week 1 – Week 3 (p <.001, d = .35), but not from Week 1 – Week 2 (p = .098, d = .23) or Week 2 – Week 3 (p = 1.00, d = .12) whereas no significant effects were seen in controls (Week 1 – Week 2: p = 1.00, d = .13; Week 1 – Week 3: p = 1.00, d = .17; Week 2 – Week 3: p = 1.00, d = .04).

To help determine any potential task differences in the DDD group alone, further exploratory *post hoc* tests with a Bonferroni adjustment, looking at the effect of time across the two tasks, reveal that this time effect was present with the DE task, $F(2, 34) = 9.33$, $p < .001$, $\eta_p^2 = .35$, but not the BA task, $F(1.46, 24.9) = 1.84$, $p = .19$, $\eta_p^2 = .10$, with variable effect sizes. This exploratory analysis suggests that the DE task may be more effective in reducing the severity of DD symptoms over time.

CDS-ABE

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on anomalous bodily experience scores (CDS-ABE; **Figure 6.6**). There were significant main effects of group, $F(1, 30) = 22.61$, $p < .001$, $\eta_p^2 = .43$, and time, $F(2, 60) = 3.69$, $p = .031$, $\eta_p^2 = .11$, on CDS-ABE scores, and a significant group x time interaction, $F(2, 60) = 5.82$, $p = .005$, $\eta_p^2 = .16$. There was no significant main effect of task type, $F(1, 30) = 3.98$, $p = .055$, $\eta_p^2 = .12$, though this trended towards significance, or any interactions between task type x group, $F(1, 30) = .37$, $p = .55$, $\eta_p^2 = .02$, task type x time, $F(1.65, 49.51) = 1.46$, $p = .24$, $\eta_p^2 = .05$, or group x task type x time, $F(1.65, 49.51) = 2.06$, $p = .15$, $\eta_p^2 = .06$.

Follow-up Bonferroni-corrected *post hoc* tests on the group x time interaction, collapsed across tasks in the two groups, revealed a significant main effect of time in the DDD group, $F(2, 34) = 8.39$, $p = .001$, $\eta_p^2 = .33$, but not in the control group, $F(2, 26) = .20$, $p = .82$, $\eta_p^2 = .02$. Pairwise comparisons with a Bonferroni adjustment revealed that CDS-ABE scores were significantly different among participants with DDD in the first week (Week 1 – Week 2: $p = .023$, $d = .29$) and Week 1 – Week 3 ($p < .001$, $d = .38$), but not the second week of the task (Week 2 – Week 3: $p = 1.00$, $d = .10$). In the control group, non-significant results were seen in all cases (Week 1 – Week 3: $p = 1.00$, $d = .08$; Week 1 – Week 2: $p = 1.00$, $d = .03$; Week 2 – Week 3: $p = 1.00$, $d = .05$). These results reveal that the severity of anomalous bodily experiences decreased in the DDD group from Week 1 – Week 2 as well as Week 1 – Week 3, with no differences seen between the two dance tasks.

To help determine any potential task differences in the DDD group alone, exploratory *post hoc* tests with a Bonferroni adjustment revealed that the time effect was present with the DE task, $F(2, 34) = 8.48$, $p = .001$, $\eta_p^2 = .33$, but not the BA task, $F(2, 34) = 1.74$, $p = .19$, $\eta_p^2 = .09$, with differing effect sizes. This exploratory analysis suggests that the DE task may be more effective in reducing anomalous bodily experiences over time in this DDD group.

MAIA-II

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on interoceptive awareness (MAIA-II scores; **Figure 6.6**). There was a significant main effect of group, $F(1, 30) = 33.06$, $p < .001$, $\eta_p^2 = .52$, reflecting higher MAIA-II scores in the control group. There was no significant main effect of time, $F(2, 60) = .65$, $p = .53$, $\eta_p^2 = .02$, or task type, $F(1, 30) = 1.46$, $p = .24$, $\eta_p^2 = .05$, or any interactions: group x task type: $F(1, 30) = .01$, $p = .95$, $\eta_p^2 = .00$; group x time: $F(2, 60) = .20$, $p = .82$, $\eta_p^2 = .01$; task type x time: $F(1.65, 49.52) = 1.56$, $p = .22$, $\eta_p^2 = .05$; group x task type x time: $F(1.65, 49.52) = 2.11$, $p = .14$, $\eta_p^2 = .07$. These results suggest that neither the BA nor DE task significantly improves interoceptive awareness across the study period.

Table 6.3 Descriptive statistics [*M* and (*SD*)] for self-report and behavioural research variables as a function of Study time point, Task Type, and Group (DDD: *n*=18, Control: *n*=14).

		DDD			Control		
Variable	**Task**	**Week 1**	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**
CDS	**BA**	126	118	118	36.4	35.3	30.2
		(40)	(42.5)	(42.5)	(25.2)	(25.5)	(26.6)
	DE	134	124	114	41	35.6	38.3
		(34.6)	(38.1)	(41.6)	(19.2)	(27.5)	(30.1)
CDS-ABE	**BA**	33.1	30.0	29.9	9.14	10.1	9.64
		(15.9)	(16.1)	(15.8)	(9.84)	(11.2)	(10.7)
	DE	38.7	32.6	29.5	10.8	10.4	11.9
		(16.3)	(14.9)	(16.9)	(8.21)	(11.6)	(12.2)
MAIA-II	**BA**	2.15	2.19	2.13	3.06	2.98	3.09
		(.46)	(.36)	(.39)	(.52)	(.44)	(.39)
	DE	2.06	2.09	2.10	2.89	3.06	2.98
		(.47)	(.47)	(.40)	(.70)	(.68)	(.64)
FFMQ	**BA**	106	111	112	127	126	133
		(18.2)	(15.1)	(15.2)	(17.8)	(24.0)	(23.0)
	DE	104	106	107	124	128	127
		(17.4)	(19.8)	(16.8)	(23.6)	(23.5)	(25.1)
BVS	**BA**	28.0	28.8	29.5	34.4	33.3	35.0
		(11.2)	(9.03)	(10.5)	(10.6)	(11.4)	(11.4)
	DE	28.8	27.6	26.2	34.3	33.8	35.5
		(11.7)	(10.6)	(11.0)	(11.0)	(11.4)	(10.8)
IAcc	**BA**	.257	.289	.247	.236	.233	.213
		(.17)	(.17)	(.17)	(.16)	(.16)	(.14)
	DE	.275	.276	.251	.31	.276	.292
		(.16)	(.17)	(.16)	(.16)	(.15)	(.14)
ISens	**BA**	-1.32	-1.68	-2.90	6.20	2.74	5.64
		(14.0)	(15.0)	(16.8)	(10.2)	(13.0)	(12.3)
	DE	-6.65	-6.63	-4.33	4.67	3.76	3.30
		(14.4)	(14.5)	(14.0)	(14.3)	(14.1)	(13.1)
VisAcc	**BA**	33.5	33.6	37.2	26.8	25.4	30.3
		(14.9)	(14.9)	(17.3)	(11.4)	(7.78)	(9.06)
	DE	32.5	29.0	33.1	25.6	26.9	27.8
		(13.8)	(14.5)	(16.2)	(9.04)	(7.94)	(7.28)
VisPropAcc	**BA**	29.6	30.7	32.7	30.3	29.0	31.7
		(12.9)	(10.9)	(12.2)	(12.2)	(11.3)	(14.3)
	DE	26.6	26.0	28.9	24.7	26.4	26.7
		(7.89)	(7.91)	(7.49)	(7.53)	(4.80)	(7.75)
TB-WF (log)	**BA**	.74	.72	.70	.86	.79	.79
		(.15)	(.12)	(.19)	(.16)	(.21)	(.18)
	DE	.78	.74	.76	.79	.85	.84
		(.13)	(.15)	(.15)	(.14)	(.19)	(.19)
TB-BP	**BA**	.62	.62	.62	.56	.61	.61
		(.16)	(.11)	(.10)	(.12)	(.13)	(.14)
	DE	.62	.61	.63	.60	.61	.58
		(.08)	(.11)	(.12)	(.13)	(.16)	(.15)
CB-WF (log)	**BA**	.85	.84	.81	.82	.81	.75
		(.19)	(.14)	(.15)	(.15)	(.20)	(.23)
	DE	.86	.85	.84	.83	.78	.75
		(.06)	(.08)	(.07)	(.19)	(.12)	(.12)
CB-BP	**BA**	.56	.57	.57	.61	.63	.62
		(.13)	(.11)	(.11)	(.13)	(.11)	(.11)
	DE	.58	.57	.55	.58	.61	.65
		(.09)	(.11)	(.10)	(.14)	(.09)	(.09)

Notes. CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalisation Scale – Anomalous Bodily Experience*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness*; FFMQ = *Five Facet Mindfulness Questionnaire*; BVS = *Body Vigilance Scale*; IAcc = *Heartbeat Detection Task Interoceptive Accuracy*; ISens = *Heartbeat Detection Task Interoceptive Sensibility*; VisAcc = *Visual Condition of Endpoint Matching Task*; VisPropAcc = *Visual & Proprioceptive Condition of Endpoint Matching Task*; TB-WF (log) = *Weber Fraction of Temporal Bisection Task*; TB-BP = *Bisection Point of Temporal Bisection Task;* CB-WF (log) = *Weber Fraction of Colour Bisection Task*; CB-BP = *Bisection Point of Colour Bisection Task.*

FFMQ

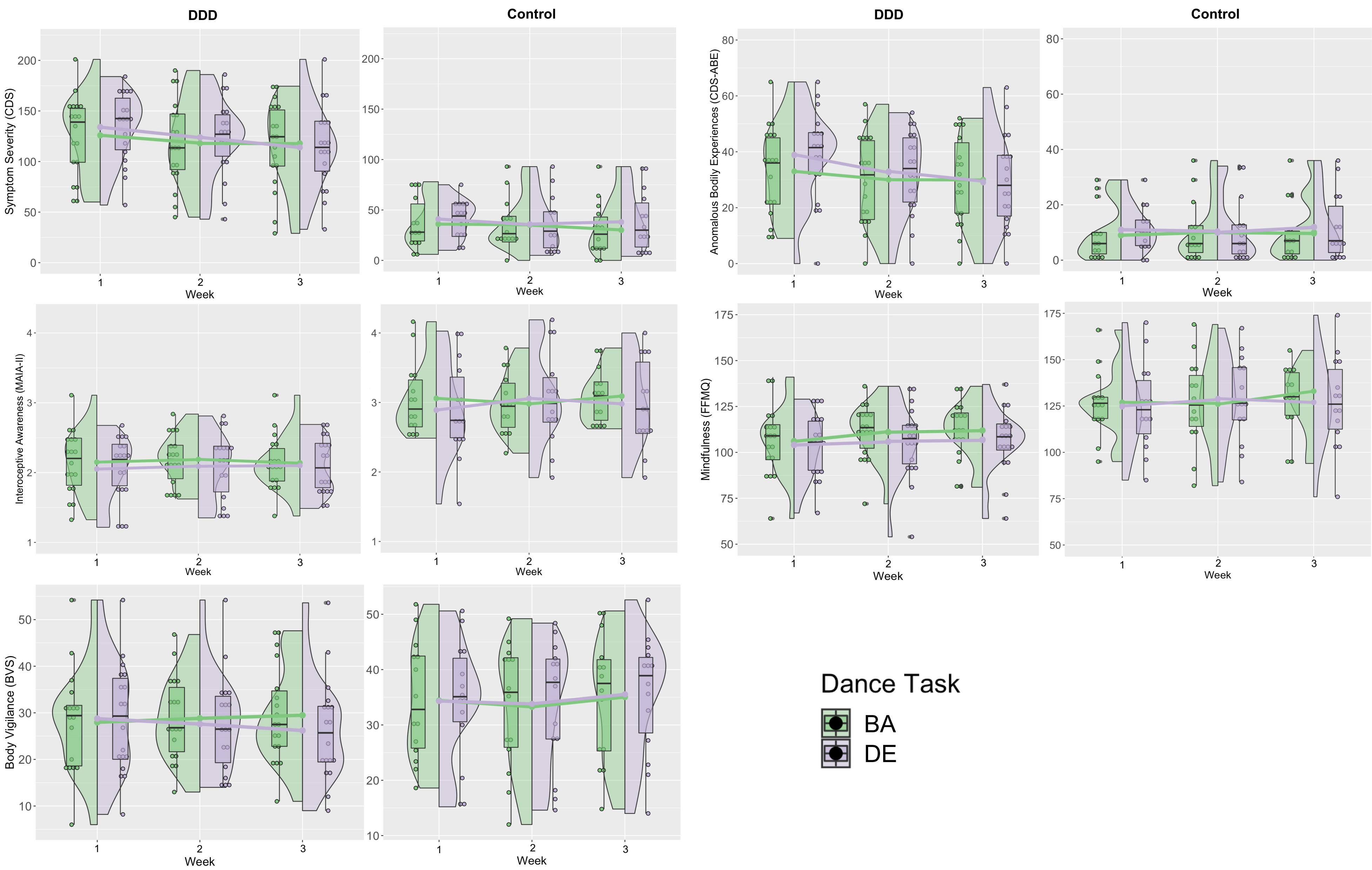
A three-way mixed-model ANOVA was performed to evaluate the effects of group, task type, and time on mindfulness (FFMQ total scores; **Figure 6.6**). There were significant main effects of group, $F(1, 30) = 9.16$, $p = .005$, $\eta_p^2 = .23$, and time, $F(2, 60) = 6.04$, $p = .004$, $\eta_p^2 = .17$, but no significant main effect of task type, $F(1, 30) = 3.49$, $p = .071$, $\eta_p^2 = .10$, or any interactions between group x task type, $F(1, 30) = .45$, $p = .51$, $\eta_p^2 = .02$, group x time, $F(2, 60) = .29$, $p = .75$, $\eta_p^2 = .01$, task type x time, $F(2, 60) = 1.54$, $p = .22$, $\eta_p^2 = .05$, or group x task type x time, $F(2, 60) = 1.79$, $p = .18$, $\eta_p^2 = .06$.

Follow-up *post hoc* tests, with a Bonferroni adjustment, revealed significant differences in FFMQ scores in the total sample from Week 1 – Week 3 ($p = .003$, $d = .61$) but not from Week 1 – Week 2 ($p = .12$, $d = .37$) or Week 2 – Week 3 ($p = .57$, $d = .24$). These results suggest that mindfulness increases across the two-week study period, from Week 1 – Week 3, with no apparent differences between the two dance tasks. Exploratory *post hoc* tests to examine changes in mindfulness in each group separately revealed non-significant differences between time points in the DDD group (Week 1 – Week 2: $p = .76$, $d = .20$; Week 1 – Week 3: $p = .26$, $d = .27$; Week 2 – Week 3: $p = 1.00$, $d = .06$) and in controls (Week 1 – Week 2: $p = 1.00$, $d = .07$; Week 1 – Week 3: $p = .27$, $d = .20$; Week 2 – Week 3: $p = 1.00$, $d = .13$). It appears that although in both groups there was a trend towards improvements in mindfulness scores, these improvements did not reach statistical significance in either group, for either task.

BVS

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on body vigilance (BVS scores; **Figure 6.6**). These results were nonsignificant in all cases: group, $F(1, 29) = 2.87$, $p = .10$, $\eta_p^2 = .09$; time, $F(2, 58) = .76$, $p = .47$, $\eta_p^2 = .03$; task type, $F(1, 29) = .04$, $p = .85$, $\eta_p^2 = .001$; group x task type, $F(1, 29) = .23$, $p = .64$, $\eta_p^2 = .01$; group x time, $F(2, 58) = .91$, $p = .41$, $\eta_p^2 = .03$; time x task type, F(1.33, 38.62) = .94, p = .34, η_p^2 = .03; group x time x task type, $F(1.33, 38.62)$ = 1.57, p = .22, η_p^2 = .05. These results suggest that neither dance task significantly altered levels of body vigilance across the study period.

Figure 6.6 Self-report research variables (symptom severity, interoceptive awareness, mindfulness, body vigilance) measured from Week 1 – Week 3.



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness – II*; FFMQ = *Five Facet Mindfulness Questionnaire*; BVS = *Body Vigilance Scale.*

6.4.3 Behavioural

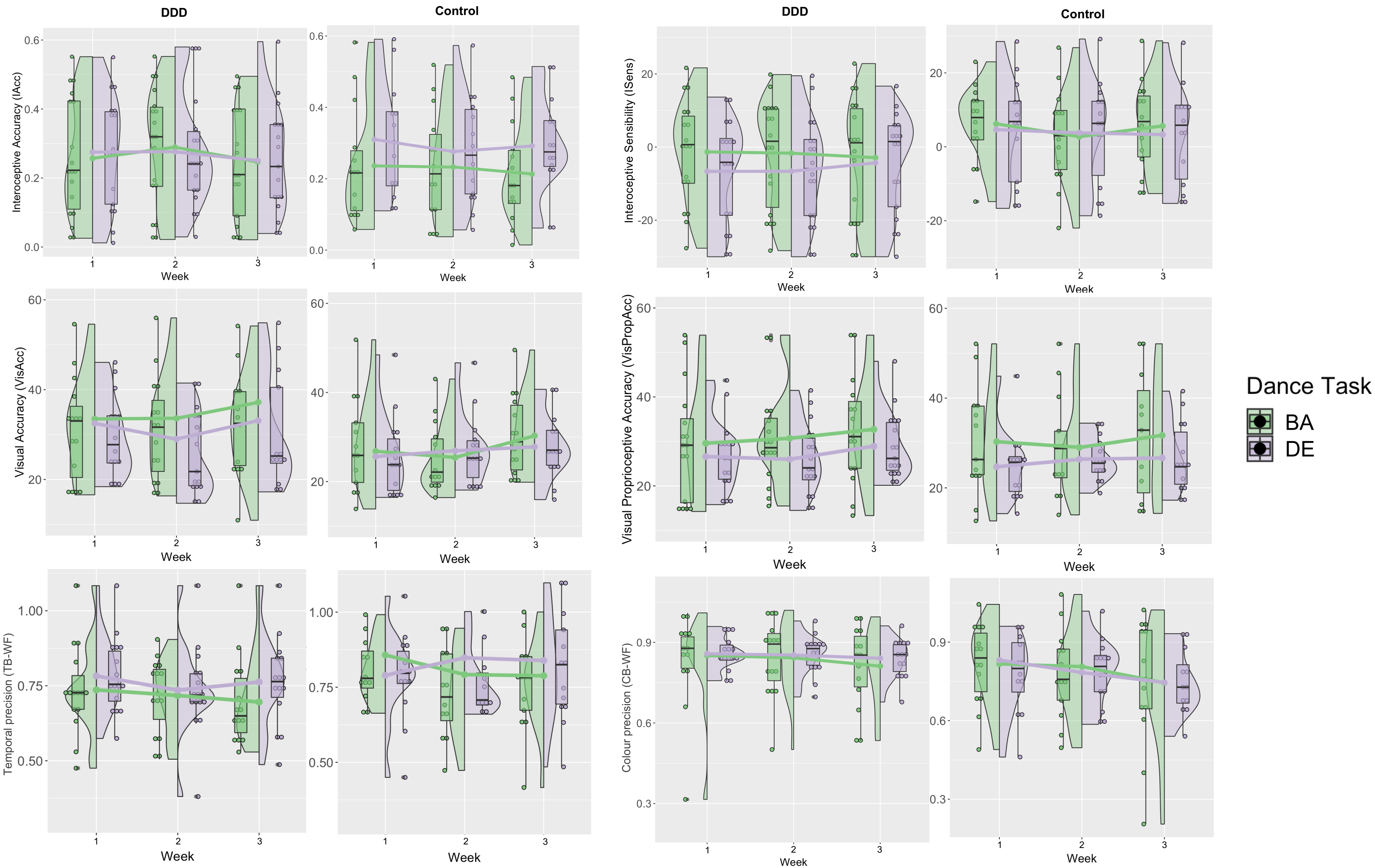
Interoceptive Accuracy

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on interoceptive accuracy (mean error rate in heartbeat detection task; Schandry, 1981; **Figure 6.7**). All effects were non-significant, group: $F(1, 26) = .02$, $p = .89$, $\eta_p^2 = .001$; time: $F(2, 52) = 2.37$, $p = .10$, $\eta_p^2 = .08$; task type: $F(1, 26) = 1.61$, $p = .22$, $\eta_p^2 = .06$; group x task type: $F(1, 26) = 1.57$, $p = .22$, $\eta_p^2 = .06$; group x time: $F(2, 52) = .78$, $p = .47$, $\eta_p^2 = .03$; time x task type: $F(2, 52) = .99$, $p = .38$, $\eta_p^2 = .04$; group x time x task type: $F(2, 52) = .14$, $p = .87$, $\eta_p^2 = .01$. These results suggest that neither dance task significantly altered interoceptive accuracy across the study period.

Interoceptive Sensibility

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on interoceptive sensibility (mean confidence level with regard to the heartbeat detection task, Schandry, 1981; **Figure 6.7**). A borderline significant main effect of task type was found, $F(1, 26) = 4.41$, $p = .046$, $\eta_p^2 = .15$, with no other significant main effects or interactions present: group, $F(1, 26) = 3.32$, $p = .08$, $\eta_p^2 = .11$; time, $F(2, 52) = .65$, $p = .53$, $\eta_p^2 = .02$; group x task type, $F(1, 26) = 2.59$, $p = .12$, $\eta_p^2 = .09$; group x time, $F(2, 52) = .75$, $p = .48$, $\eta_p^2 = .03$; time x task type, $F(1.54, 40.01) = .30$, $p = .68$, $\eta_p^2 = .01$; group x time x task type, $F(1.54, 40.01) = 1.72$, $p = .20$, $\eta_p^2 = .06$. This near-significant main effect of task type appears to have been driven by differences in Time 1 scores. These results suggest that neither task significantly altered confidence on interoceptive accuracy judgments, as measured with the heartbeat detection task, across the study period in both the DDD and control groups.

Figure 6.7 Behavioural research variables (interoceptive accuracy, interoceptive sensibility, proprioceptive accuracy, temporal, and colour precision) measured from Week 1 – Week 3.



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; IAcc = *Interoceptive Accuracy*; ISens = *Interoceptive Sensibility*; VisAcc = *Visual Accuracy*; VisPropAcc = *Visual Proprioceptive Accuracy*; Temporal Precision (TB-WF) = *Weber Fraction reflecting Temporal Precision*; Colour Precision (CB-WF) = *Weber Fraction reflecting Colour Precision.*

Proprioceptive Accuracy

A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time on proprioceptive accuracy (matching error in endpoint matching task, Jola, Davis, & Haggard, 2011; **Figure 6.7**). In the visual condition, a significant main effect of time was found, $F(1.6, 38.29) = 8.25$, $p = .002$, $\eta_p^2 = .26$, with no other significant effects: group, $F(1, 24) = 2.69$, $p = .11$, $\eta_p^2 = .10$; task type, $F(1, 24) = 2.25$, $p = .15$, $\eta_p^2 = .01$; group x task type, $F(1, 24) = 1.02$, $p = .32$, $\eta_p^2 = .04$; group x time, $F(2, 48) = 1.02$, $p = .32$, $\eta_p^2 = .04$; task type x time, $F(2, 48) = 1.05$, $p = .36$, $\eta_p^2 = .04$; group x task type x time, $F(2, 48) = 1.10$, $p = .34$, $\eta_p^2 = .04$.

Follow-up *post hoc* tests, with a Bonferroni adjustment, on the significant main effect of time in the total sample revealed significant differences from Week 1 – Week 3 ($p = .02$, $d = .56$) and Week 2 – Week 3 ($p < .001$, $d = .77$), but not from Week 1 – Week 2 ($p = .82$, $d = .22$). These results suggest that proprioceptive accuracy in the visual only condition actually worsened across the study period, both from Week 1 – Week 3 and Week 2 – Week 3, with no differences seen between the two dance tasks. To help determine any potential differences in the two groups separately across time, exploratory *post hoc* tests with a Bonferroni adjustment revealed a significant effect of time in the DDD group from Week 2 – Week 3 ($p = .011$, $d = .24$), but not from Week 1 – Week 3 ($p = .61$, $d = .14$), or Week 1 – Week 2 ($p = 1.00$, $d = .12$). Non-significant results were found in all cases in the control group (Week 1 – Week 2: $p = 1.00$, $d = .005$; Week 1 – Week 3: $p = .97$, $d = .31$; Week 2 – Week 3: $p = .93$, $d = .36$). This suggests that, in the DDD group, proprioceptive accuracy may have gotten worse, with a larger matching error seen by Week 3.

In the visual and proprioceptive condition, nonsignificant results were found in all cases: group, $F(1, 23) = .02$, $p = .88$, $\eta_p^2 = .001$; time, $F(2, 46) = 2.84$, $p = .07$, $\eta_p^2 = .11$; task type, $F(1, 23) = 3.37$, $p = .08$, $\eta_p^2 = .13$; group x task type, $F(1, 23) = .13$, $p = .73$, $\eta_p^2 = .01$; group x time, $F(2, 46) = .13$, $p = .88$, $\eta_p^2 = .01$; time x task type, $F(2, 46) = .003$, $p = .99$, $\eta_p^2 = .00$; group x time x task type, $F(2, 46) = .67$, $p = .52$, $\eta_p^2 = .03$. These results suggest that neither task significantly altered proprioceptive accuracy in the visual and proprioceptive condition across the study period.

Temporal and Colour Precision

A four-way mixed-model ANOVA was performed to evaluate the effects of group, dance task, time, and bisection task (TB vs. CB) on Weber Fraction (WF; **Figure 6.7**) values, wherein lower values reflect superior temporal precision. There was a significant main effect of time, $F(2, 44) = 11.27$, $p < .001$, $\eta_p^2 = .34$, as well as a significant bisection task x group interaction, $F(1, 22) = 5.11$, $p = .034$, $\eta_p^2 = .19$. No other significant main effects of group, $F(1, 22) = .18$, $p = .68$, $\eta_p^2 = .01$, dance task, $F(1, 22) = 1.30$, $p = .27$, $\eta_p^2 = .06$, or bisection task, $F(1, 22) = .80$, $p = .38$, $\eta_p^2 = .04$, were found, nor any other significant interactions, with uniformly low effect sizes: time x group, $F(2, 44) = 1.98$, $p = .15$, $\eta_p^2 = .08$, dance task x group, $F(1, 22) = .57$, $p = .46$, $\eta_p^2 = .03$, time x dance task, $F(2, 44) = .54$, $p = .59$, $\eta_p^2 = .02$, time x dance task x group, $F(2, 44) = .16$, $p = .85$, $\eta_p^2 = .01$, time x bisection task, $F(2, 44) = .80$, $p = .46$ $\eta_p^2 = .04$, time x bisection task x group, $F(2, 44) = 1.25$, $p = .30$, $\eta_p^2 = .05$, dance task x bisection task, $F(1, 22) = .37$, $p = .55$, $\eta_p^2 = .02$, dance task x bisection task x group, $F(1, 22) = .18$, $p = .68$, $\eta_p^2 = .008$, time x dance task x bisection task, $F(2, 44) = 1.48$, $p = .24$, $\eta_p^2 = .06$, and time x dance task x bisection task x group, $F(2, 44) = 2.72$, $p = .077$, $\eta_p^2 = .11$.

Bonferroni-corrected *post hoc* tests on the significant main effect of time (averaged over levels of group, dance task and bisection task), revealed significant differences in WF values from Week 2 – Week 3 ($p = .024$, $d = .57$) and Week 1 – Week 3 ($p < .001$, $d = .96$), but not from Week 1 – Week 2 ($p = .17$, $d = .40$). These results suggest that temporal precision improved across the study period, specifically from Week 2 – Week 3 and Week 1 – Week 3, regardless of dance task. To help determine any potential differences in the two groups separately across time, exploratory *post hoc* tests with a Bonferroni adjustment revealed a significant effect of time in the control group from Week 1 – Week 3 ($p = .001$, $d =$

.25) and Week 2 – Week 3 (p = .027, d = .14), though not from Week 1 – Week 2 (p = 1.00, d = .10). By contrast, non-significant results were seen in all cases in the DDD group (Week 1 – Week 2: p = 1.00, d = .16; Week 1 – Week 3: p = .34, d = .22; Week 2 – Week 3: p = 1.00, d = .08).

Post hoc tests, with a Bonferroni adjustment, to unpack the group x bisection task interaction on WFs revealed a large significant effect of task (averaged across time and dance task) in the DDD group, $F(1, 11) = 6.35$, $p = .028$, $\eta_p^2 = .37$ but a non-significant effect in the control group, $F(1, 11) = .77$, $p = .40$, $\eta_p^2 = .07$. This suggests that the group x bisection task interaction was driven by the DDD group exhibiting super precision in the TB than in the CB task and the opposite being true of the control group. This ties in with the baseline group difference seen in TB-WF values wherein the DDD group exhibited superior temporal precision compared to controls.

After removing the 29 sessions that had displayed poor fit (i.e, $p$dev<.05) and re-running the ANOVA, there were four additional significant effects, including time x group, $F(2, 14) = 4.17$, $p = .038$, $\eta_p^2 = .37$, bisection task x group, $F(1, 7) = 10.84$, $p = .013$, $\eta_p^2 = .61$, dance task x bisection task, $F(1, 7) = 7.61$, $p = .028$, $\eta_p^2 = .52$, and dance task x bisection task x group, $F(2, 14) = 9.22$, $p = .019$, $\eta_p^2 = .57$.

Post hoc tests, with a Bonferroni correction, on the time x group interaction revealed a significant main effect of time (collapsed across dance task and bisection task) in the control group, $F(2, 10) = 20.71$, $p < .001$, $\eta_p^2 = .81$, but not in the DDD group, $F(2, 4) = .10$, $p = .91$, $\eta_p^2 = .05$. This suggests that from Week 1 – Week 3, temporal precision improved in the control group to the level of that in the DDD group. This could be a training effect, but also may imply an effect equivalent to a regression to the mean in that the more practice the control group has, the better they get at the tasks.

Examining the bisection task x group interaction, *post hoc* tests revealed a non-significant main effect of bisection task in both the control group, $F(1, 5) = .70$, $p = .44$, $\eta_p^2 = .12$, and the DDD group, $F(1, 2) = 16.45$, $p = .056$, $\eta_p^2 = .89$. This significant interaction again appears to be driven by the DDD group exhibiting lower WF values with the time task but higher WF values with the colour task, and the opposite being true of the control group.

To unpack the dance task x bisection task x group interaction, we will look at the dance task x bisection task interaction in each participant group separately. With a Bonferroni-adjusted alpha of .004, this interaction is nonsignificant in both the DDD group, $F(1, 2) = 108$, $p = .009$, $\eta_p^2 = .98$, and the control group, $F(1, 5) = .043$, $p = .85$, $\eta_p^2 = .01$. In the DDD group, this trend towards an interaction appears to be due to a significant difference in WF scores between the time and colour bisection tasks across both dance tasks.

An exploratory four-way mixed ANOVA was performed to evaluate the effects of group, dance task, time, and bisection task (time vs. colour) on bisection point scores, wherein larger values reflect a relative underestimation. As this is an exploratory analysis, we are using a lower threshold for significance ($\alpha < .01$), however any effects < .05 are going to be treated as suggestive and worthy of further consideration. In the case of this ANOVA, significant interactions between time x group, $F(2, 44) = 4.06$, $p = .024$, $\eta_p^2 = .16$, bisection task x group, $F(1, 22) = 5.07$, $p = .035$, $\eta_p^2 = .19$, and time x bisection task x group, $F(2, 44) = 4.03$, $p = .025$, $\eta_p^2 = .16$ were found. All other results were nonsignificant: time, $F(2, 44) = 3.19$, $p = .051$, $\eta_p^2 = .13$, dance task, $F(1, 22) = .25$, $p = .63$, $\eta_p^2 = .01$, dance task x group, $F(1, 22) < .001$, $p = .99$, $\eta_p^2 < .001$, bisection task, $F(1, 22) = .86$, $p = .36$, $\eta_p^2 = .04$, time x dance task, $F(2, 44) = .29$, $p = .75$, $\eta_p^2 = .01$, time x dance task x group, $F(2, 44) = .22$, $p = .81$, $\eta_p^2 = .01$, time x bisection task, $F(2, 44) = .42$, $p = .66$, $\eta_p^2 = .02$, dance task x bisection task, $F(1, 22) = .002$, $p = .97$, $\eta_p^2 < .001$, dance task x bisection task x group, $F(1, 22) = .06$, $p = .81$, $\eta_p^2 = .003$, time x dance task x bisection task, $F(2, 44) = .35$, $p = .71$, $\eta_p^2 = .02$, time x dance task x bisection task x group, $F(2, 44) = 2.19$, $p = .12$, $\eta_p^2 = .09$.

To unpack the time x bisection task x group interaction, we will look at the time x bisection task interaction in each participant group separately. This interaction is nonsignificant in both the DDD group, $F(2, 22) = 1.51$, $p = .24$, $\eta_p^2 = .07$, and the control group, $F(2, 22) = 3.27$, $p = .057$, $\eta_p^2 = .23$. These results suggest that neither dance task significantly altered perceived duration/temporal bias across the study period.

6.4.4 Change Score Correlations

The next series of analyses examined whether task-related changes in the different research variables covaried in order to determine the extent to which the different observed effects are inter-related.

CDS, CDS-ABE & Interoceptive Accuracy

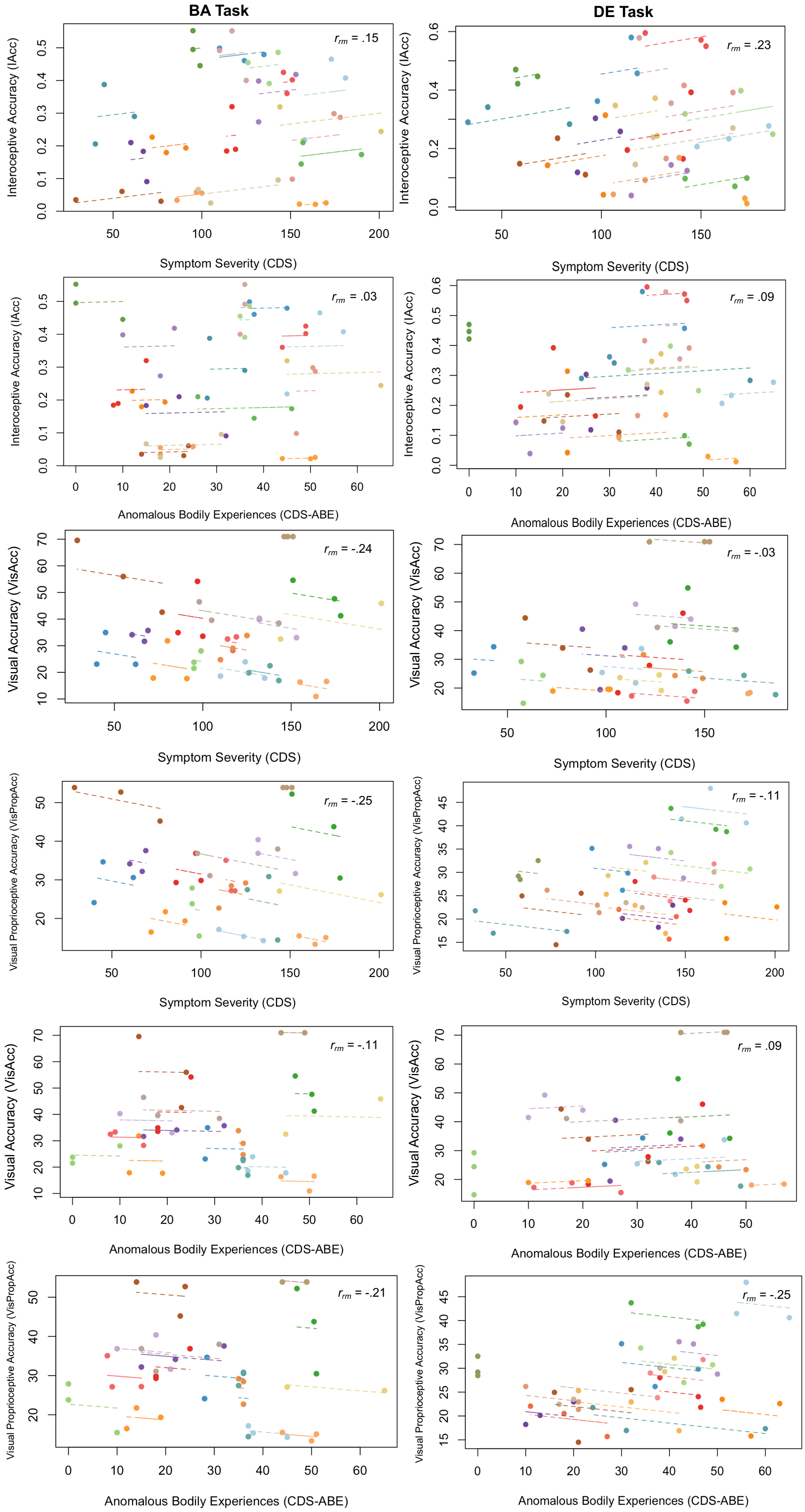
When examining the relationship between the CDS and interoceptive accuracy (**Figure 6.8**) across both weeks, nonsignificant associations were seen with both the BA task (total sample: $r_{rm}(62) = .09$, $p = .48$ [95% CI = -.16, .33]; DDD: $r_{rm}(34) = .15$, $p = .39$ [95% CI = -.20, .46]) and the DE task (total sample: $r_{rm}(60) = .23$, $p = .07$ [95% CI = -.03, .46]; DDD: $r_{rm}(33) = .23$, $p = .18$ [95% CI = -.12, .53]). These results suggest that the reduction in DD symptoms seen in those with DDD, across both tasks, is not linked to an improvement in interoceptive accuracy. Looking at this relationship between the CDS-ABE and interoceptive accuracy (**Figure 6.8**) from T1-T3, we again see no significant effects for both the BA task (total sample: $r_{rm}(62) = -.01$, $p = .91$ [95% CI = -.26, .24]; DDD: $r_{rm}(34) = .03$, $p = .86$ [95% CI = -.31, .36]) and the DE task (total sample: $r_{rm}(60) = .09$, $p = .49$ [95% CI = -.17, .34]; DDD: $r_{rm}(33) = .09$, $p = .60$ [95% CI = -.26, .42]). As above, it appears that the reduction in anomalous bodily experiences seen in those with DDD, across both tasks, is not significantly linked to an improvement in interoceptive accuracy.

CDS, CDS-ABE & Proprioceptive Accuracy

Examining the relationship between the CDS and proprioceptive accuracy (**Figure 6.8**) across both weeks of performing the tasks, nonsignificant associations were seen in both conditions (visual, and visual and proprioceptive) and in both tasks (BA: total sample visual: $r_{rm}(58) = -.12$, $p = .37$ [95% CI = -.36, .15]; total sample visual and proprioceptive: $r_{rm}(54) = -.04$, $p = .76$ [95% CI = -.31, .23]; DDD visual: $r_{rm}(30) = -.24$, $p = .19$ [95% CI = -.55, .13]; DDD visual and proprioceptive: $r_{rm}(30) = -.25$, $p = .16$ [95% CI = -.56, .12]; DE: total sample visual: $r_{rm}(56) = -.06$, $p = .64$ [95% CI = -.32, .20]; total sample visual and proprioceptive: $r_{rm}(60) = -.16$, $p = .21$ [95% CI = -.40, .10]; DDD visual: $r_{rm}(28) = -.11$, $p = .57$ [95% CI = -.46, .28]; DDD visual and proprioceptive: $r_{rm}(32) = -.21$, $p = .23$ [95% CI = -.52, .15]).

Looking at the association between the CDS-ABE and proprioceptive accuracy (**Figure 6.8**) across both weeks of performing the tasks, again nonsignificant results were seen in both conditions and in both tasks (BA: total sample visual: $r_{rm}(58) = .02$, $p = .87$ [95% CI = -.24, .28]; total sample visual and proprioceptive: $r_{rm}(54) = .02$, $p = .86$ [95% CI = -.24, .29]; DDD visual: $r_{rm}(30) = -.03$, $p = .86$ [95% CI = -.39, .33]; DDD visual and proprioceptive: $r_{rm}(30) = -.11$, $p = .55$ [95% CI = -.45, .26]; DE: total sample visual: $r_{rm}(56) = .10$, $p = .44$ [95% CI = -.17, .36]; total sample visual and proprioceptive: $r_{rm}(60) = -.16$, $p = .20$ [95% CI = -.40, .09]; DDD visual: $r_{rm}(28) = .09$, $p = .64$ [95% CI = -.29, .45]; DDD visual and proprioceptive: $r_{rm}(32) = -.25$, $p = .16$ [95% CI = -.55, .11]). These results suggest that the reduction in symptom severity seen in those with DDD, across both dance tasks, is not linked to improvements in proprioceptive accuracy.

Figure 6.8 Repeated measures correlations between changes in symptom severity and interoceptive accuracy, and symptom severity and proprioceptive accuracy from Time 1 – Time 3 in participants with DDD (*n*=15).



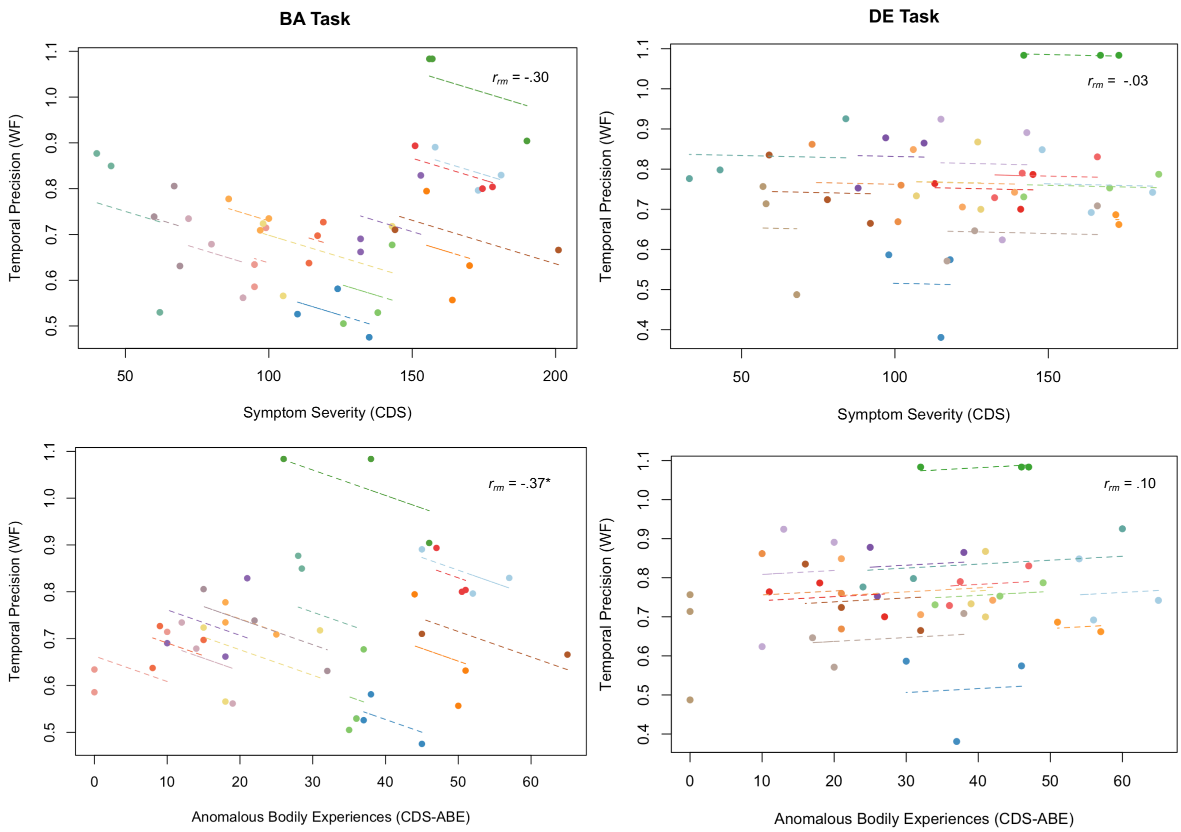
Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*; IAcc = *Interoceptive Accuracy*; VisAcc = *Visual Accuracy*; VisPropAcc = *Visual Proprioceptive Accuracy*. *p < .05

CDS, CDS-ABE & Temporal Precision

A significant negative relationship between the CDS and temporal precision (WF values in temporal bisection task, **Figure 6.9**) was seen after performance of the BA task in the total sample, $r_{rm}(56) = -.27$, $p = .037$ [95% CI = -.50, -.01], and trended towards significance, in the DDD group alone, $r_{rm}(28) = -.30$, $p = .11$ [95% CI = -.60, .09]. Nonsignificant results were seen in both the total sample, $r_{rm}(58) = -.03$, $p = .79$ [95% CI = -.29, .23], and DDD group alone, $r_{rm}(30) = -.03$, $p = .86$ [95% CI = -.39, .33], with the DE task. These results suggest that, with the BA task, better temporal precision was associated with worse DD symptom scores.

When examining the relationship between the CDS-ABE and temporal precision, a significant negative correlation was seen with the BA task in the DDD group alone, $r_{rm}(28) = -.37$, $p = .044$ [95% CI = -.65, .004], and trended towards significance in the total sample, $r_{rm}(56) = -.22$, $p = .10$ [95% CI = -.46, .04]. Nonsignificant results were again seen in the case of the DE task in both the total sample, $r_{rm}(58) = .05$, $p = .69$ [95% CI = -.21, .31], and in the DDD group alone, $r_{rm}(30) = .10$, $p = .59$ [95% CI = -.27, .44]. Similar to above, it appears that with the BA task, better temporal precision was associated with worse anomalous bodily experience scores.

Figure 6.9 Repeated measures correlations between changes in symptom severity and temporal precision from Time 1 – Time 3 in participants with DDD (n=16).



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*; Temporal Precision = *Weber Fraction of Temporal Bisection Task*. *p < .05

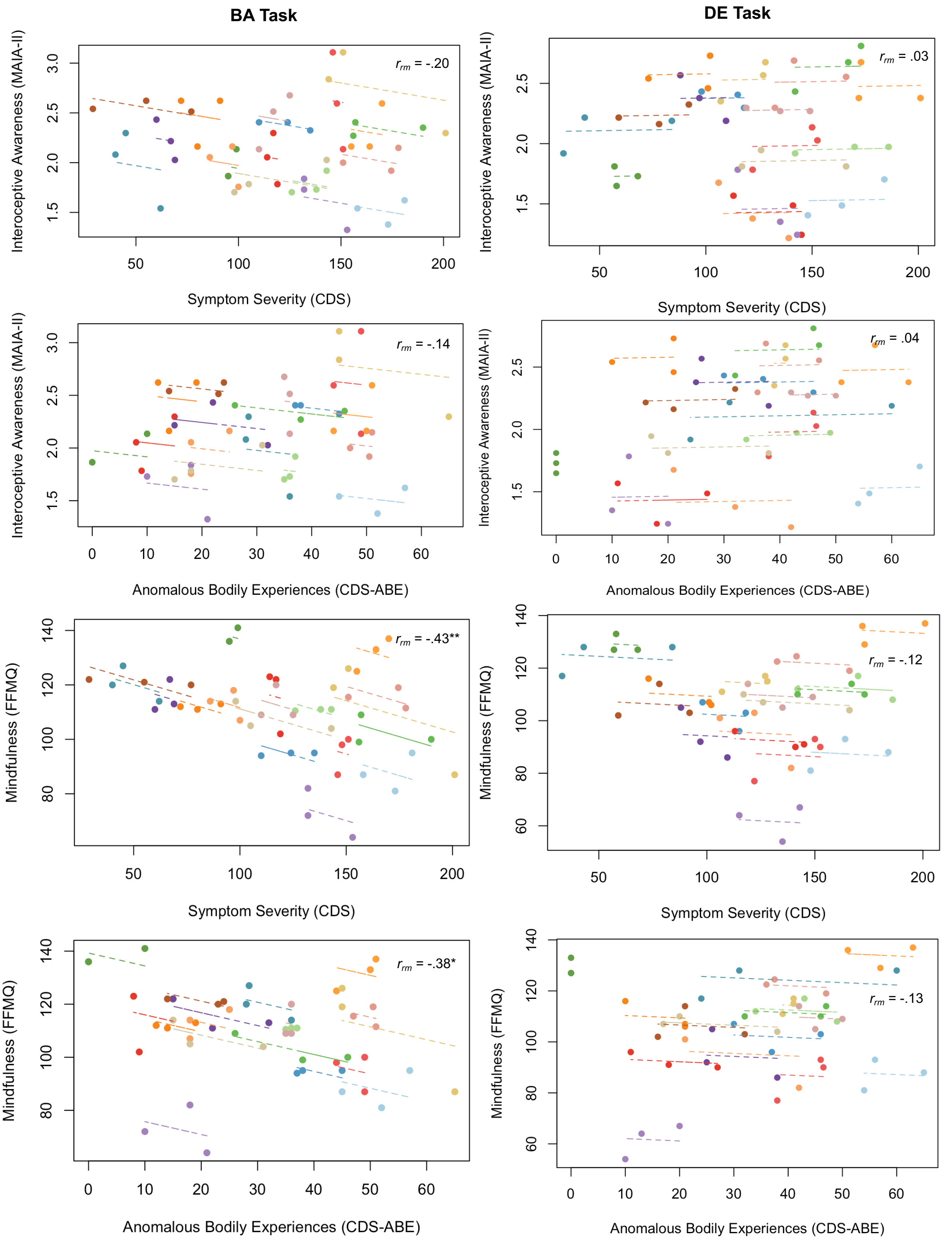
CDS, CDS-ABE & MAIA-II

Looking at the relationship between the CDS and MAIA-II (**Figure 6.10**), nonsignificant associations were seen in both tasks (BA: total sample, $r_{rm}(63) = -.15$, $p = .24$ [95% CI = -.38, .10]; DDD: $r_{rm}(35) = -.20$, $p = .24$ [95% CI = -.50, .14]; DE: total sample: $r_{rm}(63) = .03$, $p = .81$ [95% CI = -.22, .28]; DDD: $r_{rm}(35) = .03$, $p = .85$ [95% CI = -.30, .36]). These results suggest that the reduction in DD symptoms seen in those with DDD across both tasks is not linked to increasing interoceptive awareness. With regards to the CDS-ABE and MAIA-II (**Figure 6.10**) from T1-T3 after performing both tasks, again nonsignificant results were seen in all cases (BA: total sample, $r_{rm}(63) = -.03$, $p = .83$ [95% CI = -.27, .22]; DDD: $r_{rm}(35) = -.14$, $p = .41$ [95% CI = -.45, .20]; DE: total sample, $r_{rm}(63) = .04$, $p = .74$ [95% CI = -.21, .29]; DDD: $r_{rm}(35) = .04$, $p = .81$ [95% CI = -.30, .37]). Similar to the above, these results suggest that with both tasks, any reductions in anomalous bodily experiences do not appear to be associated with improvements in interoceptive awareness.

CDS, CDS-ABE & FFMQ

When examining the relationship between the CDS and FFMQ (**Figure 6.10**) after performing the BA task, significant negative correlations were seen in both the total sample, $r_{rm}(63) = -.48$, $p < .001$ [95% CI = -.65, -.27], and in the DDD group alone, $r_{rm}(35) = -.43$, $p = .007$ [95% CI = -.67, -.12]. Looking at this same relationship after performing the DE task, nonsignificant results were seen in both cases (total sample: $r_{rm}(63) = -.10$, $p = .45$ [95% CI = -.34, .16]; DDD group: $r_{rm}(35) = -.12$, $p = .48$ [95% CI = -.44, .22]). These results suggest that while performing the BA task, as mindfulness increased, DD symptom severity decreased. In the case of the CDS-ABE and FFMQ (**Figure 6.10**) after performing the BA task, significant negative correlations were again seen in both the total sample, $r_{rm}(63) = -.26$, $p = .036$ [95% CI = -.48, -.01], and in the DDD group alone $r_{rm}(35) = -.38$, $p = .020$ [95% CI = -.63, -.05]. With the DE task, nonsignificant results were again seen in both cases (total sample: $r_{rm}(63) = -.10$, $p = .41$ [95% CI = -.34, .15]; DDD group: $r_{rm}(35) = -.13$, $p = .45$ [95% CI = -.44, .22]). Similar to the above, these results suggest that while performing the BA task, as mindfulness increased, anomalous bodily experiences decreased.

Figure 6.10 Repeated measures correlations between changes in symptom severity and interoceptive awareness, and symptom severity and mindfulness from Time 1 – Time 3 in participants with DDD (*n*=18).



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness – II*; FFMQ = *Five Facet Mindfulness Questionnaire*. **p*<.05; ***p*<.01

MAIA-II & FFMQ

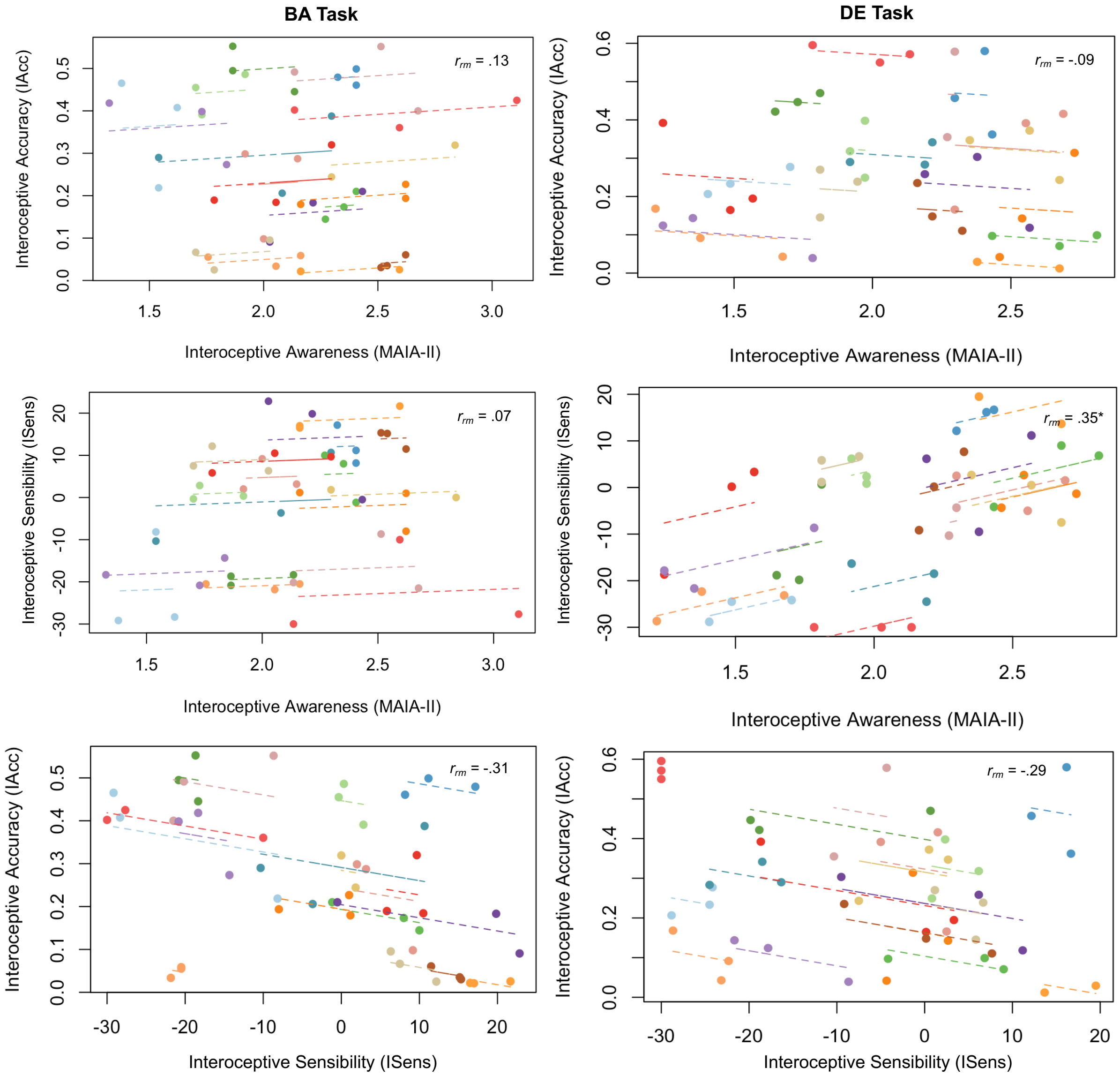
An exploration of the relationship between the MAIA-II and FFMQ revealed significant positive associations in both the BA task (total sample: $r_{rm}(63) = 0.45$, $p < .001$ [95% CI = .23, .63]; control group: $r_{rm}(27) = .44$, $p = .02$ [95% CI = .07, .70]; DDD: $r_{rm}(35) = .47$, $p = .003$ [95% CI = .16, .69]) and the DE task (total sample: $r_{rm}(63) = .44$, $p < .001$ [95% CI = .22, .62]; control group: $r_{rm}(27) = .52$, $p = .004$ [95% CI = .17, .75]; DDD group: $r_{rm}(35) = .36$, $p = .03$ [95% CI = .03, .62]). These results suggest that improvements in mindfulness are linked with improvements in interoceptive awareness, and vice versa, in the total sample and both participant groups separately.

MAIA-II, Interoceptive Accuracy & Interoceptive Sensibility

Exploring the relationship between the MAIA-II and interoceptive accuracy (**Figure 6.11**) revealed nonsignificant results across both the BA task (total sample: $r_{rm}(62) = .04$, $p = .77$ [95% CI = -.21, .28]; DDD: $r_{rm}(34) = .13$, $p = .45$ [95% CI = -.22, .45]) and DE task (total sample: $r_{rm}(60) = -.02$, $p = .87$ [95% CI = -.27, .23]; DDD group: $r_{rm}(33) = -.09$, $p = .61$ [95% CI = -.42, .26]). These results suggest that with both tasks, any changes in interoceptive awareness were not linked to interoceptive accuracy. Switching to the relationship between the MAIA-II and interoceptive sensibility (**Figure 6.11**), though nonsignificant results were seen after performing the BA task (total sample: $r_{rm}(62) = .17$, $p = .17$ [95% CI = -.08, .41]; DDD: $r_{rm}(34) = .07$, $p = .67$ [95% CI = -.27, .40]), significant positive associations were found with the DE task in both the total sample, $r_{rm}(60) = .31$, $p = .01$ [95% CI = .06, .52], and in the DDD group alone, $r_{rm}(33) = .35$, $p = .041$ [95% CI = .004, .62]. These results suggest that with the DE task, changes in interoceptive awareness were linked to changes interoceptive sensibility and vice versa.

In the case of interoceptive accuracy and interoceptive sensibility (**Figure 6.11**), a significant negative relationship was seen when performing the BA task in the total sample, $r_{rm}(61) = -.30$, $p = .02$ [95% CI = -.51, -.05], and trended towards significance in the DDD group alone, $r_{rm}(34) = -.31$, $p = .06$ [95% CI = -.59, .03]. With the DE task, nonsignificant associations were seen in the total sample, $r_{rm}(60) = -.21$, $p = .11$ [95% CI = -.44, .05], though they again trended towards significance in the DDD group alone, $r_{rm}(33) = -.29$, $p = .09$ [95% CI = -.58, .06]. These results suggest that as interoceptive accuracy improved, so did confidence in one's interoceptive accuracy (interoceptive sensibility), or vice versa.

Figure 6.11 Repeated measures correlations between changes in interoceptive awareness and interoceptive accuracy, interoceptive awareness and interoceptive sensibility, and interoceptive accuracy and interoceptive sensibility from Time 1 – Time 3 in participants with DDD (*n*=18).



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; MAIA-II = *Multidimensional Assessment of Interoceptive Awareness – II*; IAcc = *Interoceptive Accuracy*; ISens = *Interoceptive Sensibility*. **p* <.05

6.4.5 Diary Sheet

Secondary analyses included an examination of daily state DD symptom scores (12-item DPD checklist). A three-way mixed ANOVA was performed to evaluate the effects of group, task type, and time (pre, post) on mean daily state DD scores (day 1-12 mean pre-task score, days 1-12 mean post-task score). Significant main effects of group, $F(1, 29) = 30.70$, $p < .001$, $\eta_p^2 = .51$, and time, $F(1, 29) = 7.44$, $p = .001$, $\eta_p^2 = .20$, on mean state DD scores were found, as well as a borderline interaction between group x time, $F(1, 29) = 4.07$, $p = .053$, $\eta_p^2 = .12$, but no main effect of task type, $F(1, 29) = .36$, $p = .55$, $\eta_p^2 = .01$, and no significant interactions between task type x time, $F(1, 29) = .35$, $p = .56$, $\eta_p^2 = .01$, task type x group, $F(1, 29) = .06$, $p = .81$, $\eta_p^2 = .002$, or group x task type x time, $F(1, 29) = .03$, $p = .86$, $\eta_p^2 = .001$.

Further exploring this borderline group x time interaction by performing Bonferroni-corrected *post hoc* tests, collapsed across the tasks in the two groups separately, revealed a significant main effect of time in the DDD group, $F(1, 17) = 10.2$, $p = .005$, $\eta_p^2 = .38$, but not in the control group, $F(1, 12) = .40$, $p = .54$, $\eta_p^2 = .03$, suggesting that across time, daily state DD scores decreased in the DDD group.

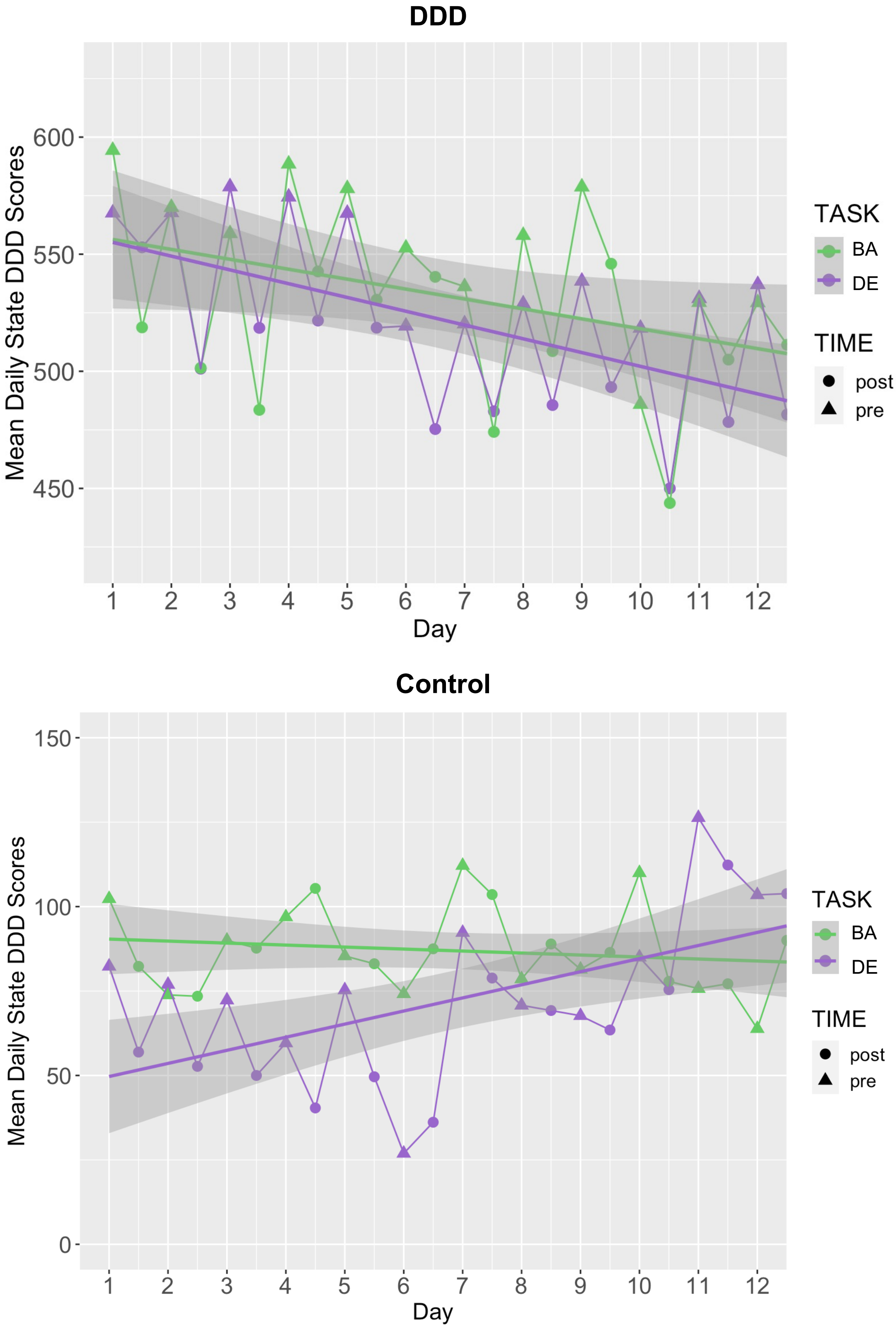
To help determine any potential task differences (see **Figure 6.12**) in the DDD group alone, exploratory *post hoc* tests with a Bonferroni adjustment revealed that the time effect was present with the DE task $F(1, 17) = 15.1$, $p = .001$, $\eta_p^2 = .47$, but not the BA task, $F(1, 17) = 3.88$, $p = .065$, $\eta_p^2 = .19$, with variable effect sizes. These results suggest that the DE task may better help to reduce the severity of daily state DD symptoms across the two weeks in this DDD group.

Examining the relationship between state (12-item DPD checklist; pre-task mean, post-task mean) and trait (CDS; Week 1 scores, Week 3 scores) DDD, we see a borderline positive correlation, $r_{rm}(93) = .20$, $p = .052$ [95% CI = -.003, .39]. This suggests an association between state and trait DD such that as state depersonalization scores decrease, trait depersonalization scores also decrease, and vice versa.

Part of the daily diary sheet asked participants to indicate how easy it was to perform the task and how they felt performing the task. In the DDD group, on average, there was no significant difference in ratings of how easy or difficult participants found the two tasks, ($t(30.46) = .69$, $p = .49$ $g = .23$; BA: $M = 3.77$, $SD = 1.13$; DE: $M = 3.45$, $SD = 1.62$), and there was also no significant difference in ratings of how participants felt after performing the tasks ($t(33.99) = -1.12$, $p = .31$, $g = .35$; BA: $M = 4.20$, $SD = 1.10$; DE: $M = 4.58$, $SD = 1.08$). In the control group, the BA task was rated as more difficult ($t(21.44) = 2.17$, $p = .041$, $g = .83$; BA: $M = 3.17$, $SD = 1.79$; DE: $M = 1.94$, $SD = 1.07$), with no significant difference seen in ratings of how participants felt after performing the task ($t(24.42) = .71$, $p = .49$, $g = .28$; BA: $M = 5.51$, $SD = 1.08$; DE: $M = 5.24$, $SD = .86$).

We also examined the level of compliance, measured by number of days the task was performed across each of the two weeks, and mean CDS scores after performing the DE and BA tasks separately, in the DDD group alone. This was non-significant for both the BA task, $r(16) = -.16$, $p = .53$ [95% CI = -.58, .33], and the DE task, $r(16) = -.30$, $p = .23$ [95% CI = -.67, .20]. It appears that the reduction in DD symptoms did not depend on how diligently people with DDD performed either the body awareness or dance exercise tasks. However, the diary results do suggest that the DE task led to more significant symptom change in the DDD group as compared to the BA task. In the absence of a no-intervention control group, it is important to point out here that any task differences over time imply that the reduction in CDS scores was not merely a result of time passing between measurement points (**Figure 6.12**).

Figure 6.12 Pre- and post-task mean daily state DDD scores from Days 1 – 12.



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; Mean Daily State DDD Scores = *12 Item DPD Checklist*; post = post-task mean; pre = pre-task mean.

6.4.6 Exploratory Analyses

Exploratory analyses investigated associations between CDS, FFMQ and MAIA-II subscales. Exploratory analyses used a lower threshold for significance ($\alpha < .01$). From Week 1 – Week 3 while performing the BA task, a significant positive correlation was seen between the CDS and MAIA-N (Noticing: $r_{rm}(35) = .48$, $p = .003$ [95% CI = .17, .70]). No other significant correlations were seen between the CDS and the other seven dimensions of the MAIA-II (MAIA-ND: $r_{rm}(35) = -.18$, $p = .29$ [95% CI = -.48, .16]; MAIA-NW: $r_{rm}(35) = -.30$, $p = .07$ [95% CI = -.57, .04]; MAIA-AR: $r_{rm}(35) = -.31$, $p = .07$ [95% CI = -.58, .03]; MAIA-EA: $r_{rm}(35) = .11$, $p = .52$ [95% CI = -.23, .43]; MAIA-SR: $r_{rm}(35) = -.15$, $p = .37$ [95% CI = -.46, .19]; MAIA-BL: $r_{rm}(35) = -.24$, $p = .15$ [95% CI = -.53, .10]; MAIA-T: $r_{rm}(35) = -.24$, $p = .16$ [95% CI = -.53, .10]). These results suggest that, contrary to what may have been expected, higher DD symptom scores were associated with higher scores on the Noticing dimension of the MAIA-II.

In the case of the DE task, no significant associations were seen between the CDS and the eight dimensions of the MAIA-II (MAIA-N: $r_{rm}(35) = .15$, $p = .37$ [95% CI = -.19, .46]; MAIA-ND: $r_{rm}(35) = -.17$, $p = .32$ [95% CI = -.47, .18]; MAIA-NW: $r_{rm}(35) = .11$, $p = .52$ [95% CI = -.23, .43]; MAIA-AR: $r_{rm}(35) = .13$, $p = .44$ [95% CI = -.21, .45]; MAIA-EA: $r_{rm}(35) = -.08$, $p = .64$ [95% CI = -.40, .26]; MAIA-SR: $r_{rm}(35) = .16$, $p = .34$ [95% CI = -.18, .47]; MAIA-BL: $r_{rm}(35) = -.17$, $p = .33$ [95% CI = -.47, .18]; MAIA-T: $r_{rm}(35) = -.14$, $p = .42$ [95% CI = -.45, .21]).

In exploring the FFMQ subscales, significant negative correlations were seen from Week 1 – Week 3 when performing the BA task between the CDS and FFMQ-AA facet (Acting with Awareness: $r_{rm}(35) = -.37$, $p = .025$ [95% CI = -.62, -.04]) and the CDS and FFMQ-NJ facet (Non-Judging: $r_{rm}(35) = -.35$, $p = .036$ [95% CI = -.61, -.01]). No other significant associations were seen while performing the BA task (FFMQ-O: $r_{rm}(35) = .29$, $p = .08$ [95% CI = -.05, .57]; FFMQ-D: $r_{rm}(35) = -.09$, $p = .59$ [95% CI = -.41, .25]; FFMQ-NR: $r_{rm}(35) = -.22$, $p = .18$ [95% CI = -.52, .12]). While performing the DE task, no significant associations were seen between the CDS and any FFMQ facets: (FFMQ-O: $r_{rm}(35) = .04$, p = .80 [95% CI = -.29, .37]; FFMQ-NJ: $r_{rm}(35) = -.26$, p = .12 [95% CI = -.55, .08]); FFMQ-D: $r_{rm}(35) = .005$, p = .98 [95% CI = -.33, .34]; FFMQ-AA: $r_{rm}(35) = -.18$, p = .30 [95% CI = -.48, .17]; FFMQ-NR: $r_{rm}(35) = .19$, p = .25 [95% CI = -.15, .49]). These results suggest that while performing the BA task, as DD symptoms decrease, one's ability to both act with awareness and not judge oneself improves in the DDD group.

Further exploratory correlations were run between the CDS, CDS-ABE, and bisection point (BP) values in the temporal bisection task. Nonsignificant results were seen in the case of the CDS and BP values with both the BA task (total sample: $r_{rm}(56) = .03$, $p = .82$ [95% CI = -.23, .29]; DDD: $r_{rm}(28) = .18$, $p = .34$ [95% CI = -.21, .52]) and the DE task (total sample: $r_{rm}(58) = -.19$, $p = .15$ [95% CI = -.42, .08]; DDD: $r_{rm}(30) = -.23$, $p = .20$ [95% CI = -.55, .14]). The same was true with the CDS-ABE and BP values, revealing nonsignificant associations in the case of both the BA task (total sample: $r_{rm}(56) = -.08$, $p = .53$ [95% CI = -.34, .18]; DDD: $r_{rm}(28) = -.006$, $p = .97$ [95% CI = -.38, .37]) and the DE task (total sample: $r_{rm}(58) = -.17$, $p = .19$ [95% CI = -.41, .09]; DDD: $r_{rm}(30) = -.20$, $p = .26$ [95% CI = -.53, .17]). These results suggest that changes in symptom scores, both overall and anomalous bodily experiences, are not linked to changes in perceived duration/temporal bias.

We also wanted to evaluate possible relationships between WF and BP values and the MAIA-II and FFMQ. With regards to temporal precision (WF) and the FFMQ, nonsignificant results were seen with both the BA task (total sample: $r_{rm}(56) = .09$, $p = .50$ [95% CI = -.18, .35]; DDD: $r_{rm}(28) = .06$, $p = .74$ [95% CI = -.32, .43]), and the DE task (total sample: $r_{rm}(58) = .15$, $p = .26$ [95% CI = -.11, .39]; DDD: $r_{rm}(30) = .18$, $p = .32$ [95% CI = -.19, .51]). The same was true for the MAIA-II and temporal precision (BA: total sample, $r_{rm}(56) = .18$, $p = .17$ [95% CI = -.09, .42, DDD, $r_{rm}(28) = .26$, $p = .16$ [95% CI = -.12, .58]; DE: total sample, $r_{rm}(58) = .01$, $p = .95$ [95% CI = -.25, .27], DDD, $r_{rm}(30) = .12$, $p = .51$ [95% CI = -.25, .46]). These results suggest that changes in temporal precision are not related to changes in the FFMQ or MAIA-II.

With regards to perceived duration/temporal bias (BP) and the FFMQ, nonsignificant results were again seen with both the BA task (total sample: $r_{rm}(56) = .08$, $p = .54$ [95% CI = -.18, .34]; DDD: $r_{rm}(28) = .18$, $p = .34$ [95% CI = -.21, .52]) and the DE task (total sample: $r_{rm}(58) = .05$, $p = .73$ [95% CI = -.22, .30]; DDD: $r_{rm}(30) = -.14$, $p = .46$ [95% CI = -.47, .24]). As above, the same was true for the MAIA-II and temporal bias (BA: total sample, $r_{rm}(56) = -.13$, $p = .32$ [95% CI = -.38, .13], DDD, $r_{rm}(28) = -.07$, $p = .71$ [95% CI = -.43, .31]; DE: total sample, $r_{rm}(58) = .05$, $p = .72$ [95% CI = -.21, .30], DDD, $r_{rm}(30) = -.13$, $p = .46$ [95% CI = -.47, .24]). These results suggest that changes in temporal bias are not related to changes in the FFMQ or MAIA-II.

Further, exploratory ANOVAs examining the other three subscales of the CDS (emotional numbing [CDS-EN], anomalous subjective recall [CDS-ASR], alienation from surroundings [CDS-AfS] **Table 6.4**) were conducted. The first three-way mixed ANOVA evaluating the effects of group, task type, and time on CDS-EN scores revealed a significant main effect of group, $F(1, 30) = 48.70$, $p < .001$, $\eta_p^2 = .62$, reflecting higher CDS-EN scores in the DDD group. There was no significant main effect of time, $F(2, 60) = 3.08$, $p = .053$, $\eta_p^2 = .09$, or task type, $F(1, 30) = .30$, $p = .59$, $\eta_p^2 = .01$, or any interactions between group x task type, $F(1, 30) = .16$, $p = .69$, $\eta_p^2 = .005$, group x time, $F(2, 60) = .14$, $p = .87$, $\eta_p^2 = .005$, task type x time, $F(1.72, 51.53) = 1.75$, $p = .19$, $\eta_p^2 = .06$, or group x task type x time, $F(1.72, 51.53) = 1.92$, $p = .16$, $\eta_p^2 = .06$.

Table 6.4 Descriptive statistics [*M* and (*SD*)] for exploratory research variables as a function of study time point, task, and Group (DDD: *n*=18, Control: *n*=14).

		DDD			Control		
Variable	**Task**	**Week 1**	**Week 2**	**Week 3**	**Week 1**	**Week 2**	**Week 3**
CDS-EN	**BA**	25.8 (12.1)	26.2 (11.9)	24.8 (11.2)	6.21 (6.08)	5.5 (5.33)	3.64 (4.16)
	DE	27.9 (11.2)	24.8 (9.57)	24.6 (10.1)	6.5 (5.26)	5.43 (5.60)	6.36 (6.20)
CDS-ASR	**BA**	23.7 (10.4)	21.3 (9.11)	21.8 (10.0)	8.79 (4.71)	8.64 (6.25)	6.07 (5.88)
	DE	22.4 (10.5)	23.2 (11.0)	20.8 (9.94)	10.4 (5.12)	8.43 (5.34)	8.5 (4.99)
CDS-AfS	**BA**	26.3 (10.4)	24.1 (8.83)	24.3 (10.7)	6.43 (4.40)	6.5 (4.59)	6.36 (4.94)
	DE	26.2 (9.20)	24.6 (8.74)	23.1 (9.29)	6.93 (3.27)	6 (5.14)	6.71 (6.68)

Notes. BA = Body Awareness task; DE = Dance Exercise task; CDS-EN = *Cambridge Depersonalization Scale – Emotional Numbing*; CDS-ASR = *Cambridge Depersonalisation Scale – Anomalous Subjective Recall*; CDS-AfS = *Cambridge Depersonalisation Scale – Alienation from Surroundings.*

The second three-way mixed ANOVA evaluating the effects of group, task type, and time on CDS-ASR scores revealed a significant main effect of group, $F(1, 30) = 27.78$, $p < .001$, $\eta_p^2 = .48$, reflecting higher CDS-ASR scores in the DDD group. There was no significant main effect of task type, $F(1, 30) = .29$, $p = .59$, $\eta_p^2 = .01$, or any interactions between group x task type, $F(1, 30) = .40$, $p = .53$, $\eta_p^2 = .01$, group x time, $F(2, 60) = .08$, $p = .93$, $\eta_p^2 = .003$, task type x time, $F(1.6, 47.91) = .21$, $p = .76$, $\eta_p^2 = .007$. A suggestive main effect of time was present, $F(2, 60) = 4.27$, $p = .018$, $\eta_p^2 = .13$, as well as a suggestive interaction between group x task type x time, $F(1.6, 47.91) = 3.57$, $p = .045$, $\eta_p^2 = .11$.

To explore the group x task type x time interaction, we will look at the task type x time interaction in each participant group separately. Bonferroni-adjusted *post hoc* tests revealed nonsignificant interactions in both the DDD group, $F(1.48, 25.1) = 1.78$, $p = .19$, $\eta_p^2 = .10$, and the control group, $F(2, 26) = 3.89$, $p = .033$, $\eta_p^2 = .23$. These exploratory results suggest that neither dance task significantly altered anomalous subjective recall in either participant group across the study period.

The third three-way mixed ANOVA evaluating the effects of group, task type, and time on CDS-AfS scores revealed a significant main effect of group, $F(1, 30) = 48.80$, $p < .001$, $\eta_p^2 = .62$, again reflecting higher scores in the DDD group. There was no significant main effect of task type, $F(1, 30) = .02$, $p = .90$, $\eta_p^2 = .001$, or any interactions between group x task type, $F(1, 30) = .10$, $p = .75$, $\eta_p^2 = .02$, , task type x time, $F(1.77, 53.12) = .20$, $p = .79$, $\eta_p^2 = .01$, or group x task type x time, $F(1.77, 53.12) = .77$, $p = .45$, $\eta_p^2 = .03$. A suggestive main effect of time was present, $F(2, 60) = 4.63$, $p = .013$, $\eta_p^2 = .13$, as well as a suggestive interaction between group x time, $F(2, 60) = 3.21$, $p = .047$, $\eta_p^2 = .10$.

Follow-up Bonferroni-corrected *post hoc* tests on the group x time interaction, collapsed across tasks in the two groups, revealed a significant main effect of time in the DDD group, $F(2, 34) = 10.6$, $p < .001$, $\eta_p^2 = .39$, but not in the control group, $F(2, 26) = .15$, $p = .87$, $\eta_p^2 = .01$. Pairwise comparisons with a Bonferroni adjustment revealed that CDS-AfS scores were significantly different among participants with DDD from Week 1 – Week 3 ($p = .002$, $d = .26$), but not from Week 1 – Week 2 ($p = .06$, $d = .20$), or Week 2 – Week 3 ($p =$

1.00, *d* = .07) separately. In the control group, nonsignificant results were seen in all cases (Week 1 – Week 3: *p* = 1.00, *d* = .03; Week 1 – Week 2: *p* = 1.00, *d* = .10; Week 2 – Week 3: *p* = 1.00, *d* = .05). These results suggest that the severity of alienation from surroundings decreased in the DDD group from Week 1 – Week 3, with no differences seen between the two dance tasks. To help determine any potential task differences in the DDD group alone, exploratory *post hoc* tests with a Bonferroni adjustment revealed that the time effect was present with the DE task, $F(2, 34) = 5.73$, $p = .007$, $\eta_p^2 = .25$, but not the BA task, $F(2, 34) = 2.72$, $p = .08$, $\eta_p^2 = .14$, with differing effect sizes. This exploratory analysis suggests that the DE task may be more effective in reducing alienation from surroundings over time in the DDD group.

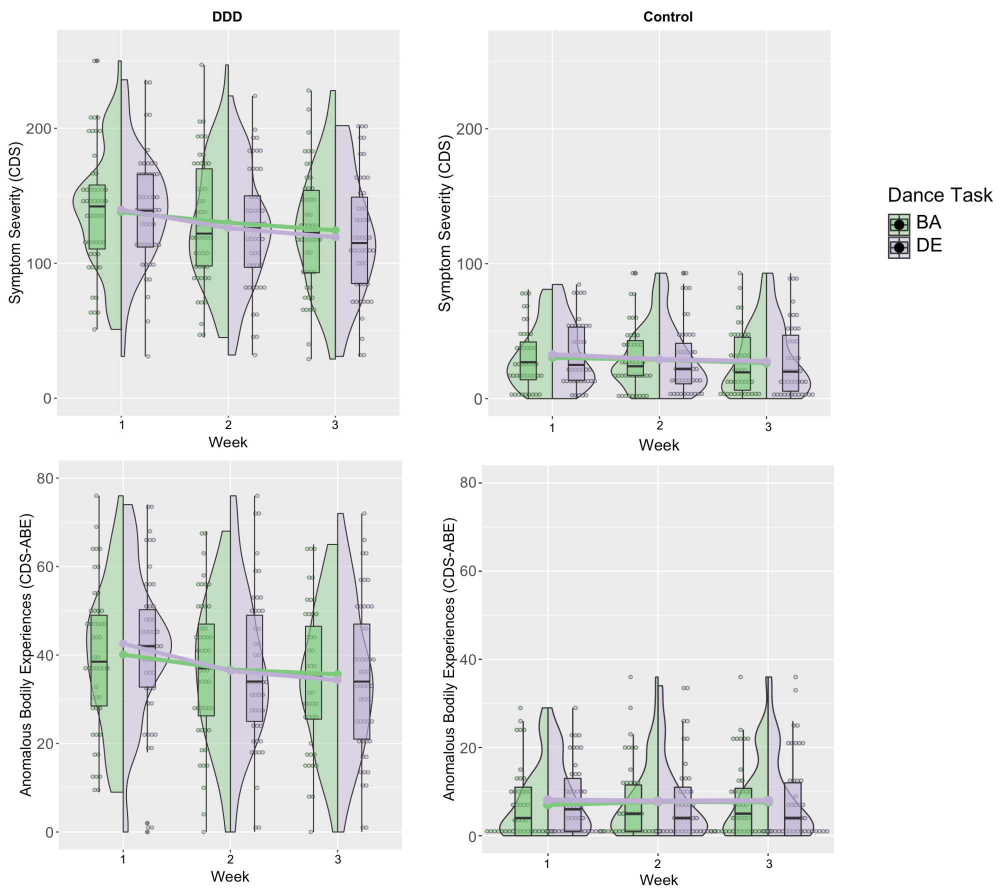
Finally, it seemed important to include, within this thesis, an exploratory analysis of both the CDS and CDS-ABE scores collapsed across the online and in-person participant samples. As we have alluded to the idea of dance task differences in Chapter 5, as well as in some of the exploratory follow-up *post hoc* tests on the ANOVAS presented in this Chapter, running an analysis on this entire sample may help to better unpack this. Pooling these samples together resulted in sample sizes of *n*=49 (DDD) and *n*=43 (Control).

Evaluating the effects of group, task type, and time on total CDS scores (**Figure 6.13**) revealed a significant main effect of group, $F(1, 88) = 212.51$, $p < .001$, $\eta_p^2 = .71$, and time, $F(1.62, 142.65) = 28.63$, $p < .001$, $\eta_p^2 = .25$, as well as a significant interaction between group x time, $F(1.62, 142.65) = 9.03$, $p < .001$, $\eta_p^2 = .09$. There was no significant main effect of task type, $F(1, 88) = .07$, $p = .79$, $\eta_p^2 < .001$, and no interactions between group x task type, $F(1, 88) = .60$, $p = .44$, $\eta_p^2 = .007$, task type x time, $F(2, 176) = 1.20$, $p = .31$, $\eta_p^2 = .01$, and group x task type x time, $F(2, 176) = .23$, $p = .79$, $\eta_p^2 = .003$.

Follow-up Bonferroni-corrected *post hoc* tests on the group x time interaction, collapsed across tasks in the two groups, revealed a significant main effect of time in the DDD group, $F(1.61, 75.5) = 26.6$, $p < .001$, $\eta_p^2 = .36$, but not in the control group, $F(1.57, 64.2) = 4.81$, $p = .018$, $\eta_p^2 = .11$. Pairwise comparisons with a Bonferroni adjustment revealed that CDS scores were significantly different among participants with DDD in the first week (Week 1 – Week 2: $p < .001$, $d = .25$), and across the entire study period (Week 1 – Week 3: $p < .001$, $d = .39$), but not in the second week alone (Week 2 – Week 3: $p = .03$, $d = .14$). In the control group, non-significant results were seen in all cases (Week 1 – Week 2: $p = 1.00$, $d = .11$; Week 1 – Week 3: $p = .39$, $d = .19$; Week 2 – Week 3: $p = 1.00$, $d = .08$). These results reveal that the severity of overall DD symptoms decreased in the DDD group across the two-week study period, with no differences seen between the two dance tasks.

To again help to determine any potential task differences in the DDD group alone, exploratory *post hoc* tests with a Bonferroni adjustment revealed that the time effect was present with both the DE task, $F(1.74, 83.5) = 20.6$, $p < .001$ $\eta_p^2 = .30$, and the BA task $F(2, 94) = 10.4$, $p < .001$, $\eta_p^2 = .18$. This exploratory analysis suggests that both dance tasks work to reduce DD symptoms across the study period.

Figure 6.13 CDS and CDS-ABE in collapsed online and in-person sample from Week 1 – Week 3 (DDD *n*=49; Control *n*=43).



Notes. BA = *Body Awareness Task*; DE = *Dance Exercise Task*; CDS = *Cambridge Depersonalization Scale*; CDS-ABE = *Cambridge Depersonalization Scale – Anomalous Bodily Experiences*

Evaluating the effects of group, task type, and time on CDS-ABE scores (**Figure 6.13**) revealed a significant main effect of group, $F(1, 88) = 129.99$, $p < .001$, $\eta_p^2 = .60$, and time, $F(1.88, 165.83) = 13.73$, $p < .001$, $\eta_p^2 = .14$, as well as a significant interaction between group x time, $F(1.88, 165.83) = 14.75$, $p < .001$, $\eta_p^2 = .14$. There was no significant main effect of task type, $F(1, 88) = .11$, $p = .74$, $\eta_p^2 = .001$, and no interactions between group x task type, $F(1, 88) = .03$, $p = .85$, $\eta_p^2 < .001$, task type x time, $F(1.87, 164.81) = 2.64$, $p = .08$, $\eta_p^2 = .03$, and group x task type x time, $F(1.87, 164.81) = .84$, $p = .43$, $\eta_p^2 = .01$.

Follow-up Bonferroni-corrected *post hoc* tests on the group x time interaction, collapsed across tasks in the two groups, revealed a significant main effect of time in the DDD group, $F(2, 94) = 20.2$, $p < .001$, $\eta_p^2 = .30$, but not in the control group, $F(2, 82) = .02$, $p = .98$, $\eta_p^2 < .001$. Pairwise comparisons with a Bonferroni adjustment revealed that CDS-ABE scores were significantly different among participants with DDD in the first week (Week 1 – Week 2: p < .001, d = .25), second week (Week 2 – Week 3: p < .001, d = .12), and across the entire study period (Week 1 – Week 3: p < .001, d = .37). In the control group, non-significant results were seen in all cases (Week 1 – Week 2: $p = 1.00$, $d = .03$; Week 1 – Week 3: $p = 1.00$, $d = .03$; Week 2 – Week 3: $p = 1.00$, $d = .003$). These results reveal that the severity of anomalous bodily experiences decreased in the DDD group across the two-week study period, as well as during each of the weeks individually, with no differences seen between the two dance tasks.

To again examine any potential task differences in the DDD group alone, exploratory *post hoc* tests with a Bonferroni adjustment revealed that the time effect was present with both the DE task, $F(1.69, 81.2) = 15.9$, $p < .001$ $\eta_p^2 = .25$, and the BA task $F(2, 94) = 7.58$, $p = .001$, $\eta_p^2 = .14$. This exploratory analysis suggests that both dance tasks work to reduce anomalous bodily experiences across the study period.

6.4.7 Objective measures of task performance

Participants were asked to wear an Empatica E4 wrist sensor at home during their daily task performance to monitor physiological signals and acceleration. A combination of technical issues and participants forgetting to wear the sensor resulted in large amounts of missing data, both for full sessions as well as sessions being cut off prior to their completion. Because of all of these factors, we have focused in on a subset of the data as a pilot analysis of this type of data in the context of this study. We extracted the data for Day 1, or the earliest recorded session, well as Day 12, or the last recorded session, for each individual, both in the DDD group and control group, and for both tasks. For each of these days, due to the large amounts of missing data, an interval was selected for analysis where no missing data was present. This resulted in the analysis of minutes 4 – 9 in the case of both tasks, for both days. For both the BA and DE tasks, this includes the end of the warmup followed by the first few minutes of the task. Since we are interested in the general levels of activity and physical exercise elements across the two tasks, using heart rate and acceleration as activity measures, we have collapsed these initial analyses across both the DDD group and the control group.

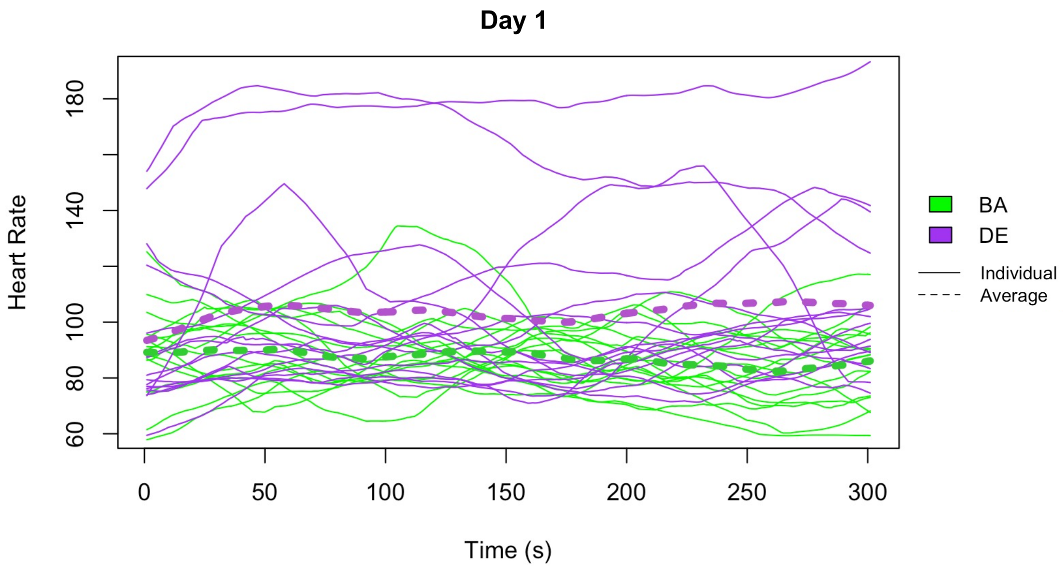
Heart Rate

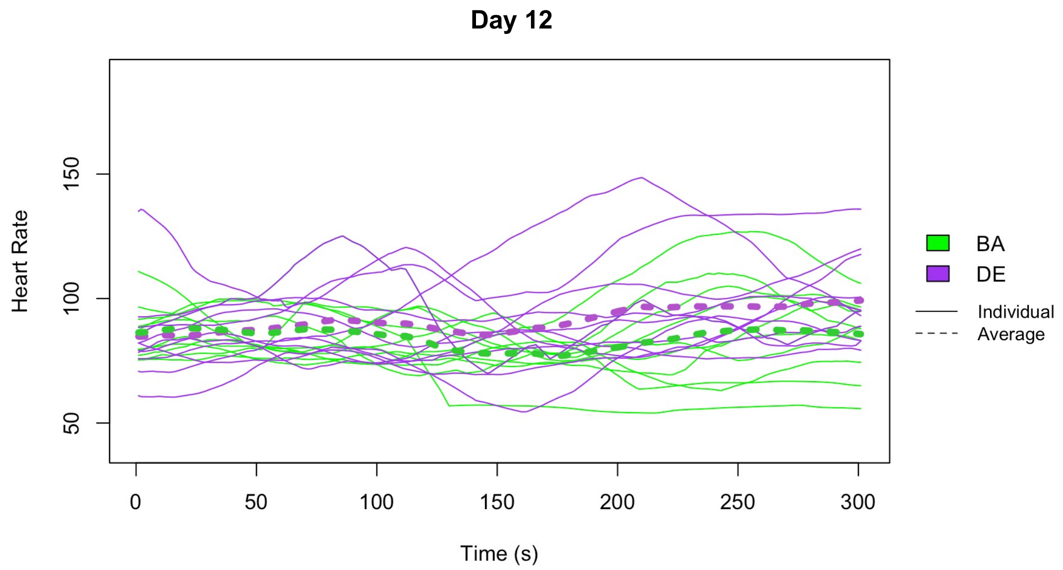
Figure 6.14a depicts both the individual and the average heart rates of participants on Day 1 (n=16) of the tasks. Heart rate was sampled at 1 Hz throughout task performance. Across this 5-minute period, the average heart rate was significantly higher, $t(15) = -2.35$, $p = .03$, $g = .80$, in the DE task (M=104, SD=28.5) than in the BA task (M=87.1, SD=8.83). This suggests that the two tasks differently engage with the body and its physiology.

Figure 6.14b depicts both the individual and the average heart rates of participants on Day 12 (n=11) of the tasks. Across this 5-minute period, heart rate of these participants did not significantly differ, $t(10) = -1.70$, $p = .12$, $g = .68$, between the DE Task (M=91.3, SD=12.2) and the BA Task (M=84.2, SD=8.46). This may imply a possible fitness effect across the completion of the DE task, wherein daily practice of the dance exercise could lead to the task becoming easier as the body gets used to this type of cardio.

Overall, while there are clear individual differences present (**Figure 6.14**), the DE task produces a higher average heart rate as compared to the BA task. This follows on with what one would expect, given the active cardio involved in the dance exercise. This measure helps to clarify the physiological differences between the two tasks.

Figure 6.14 Individual and average heart rate on Day 1 (*n*=16) and Day 12 (*n*=11).





Notes. BA = Body Awareness task; DE = Dance Exercise task.

Baseline HR differences as a proxy for general fitness level

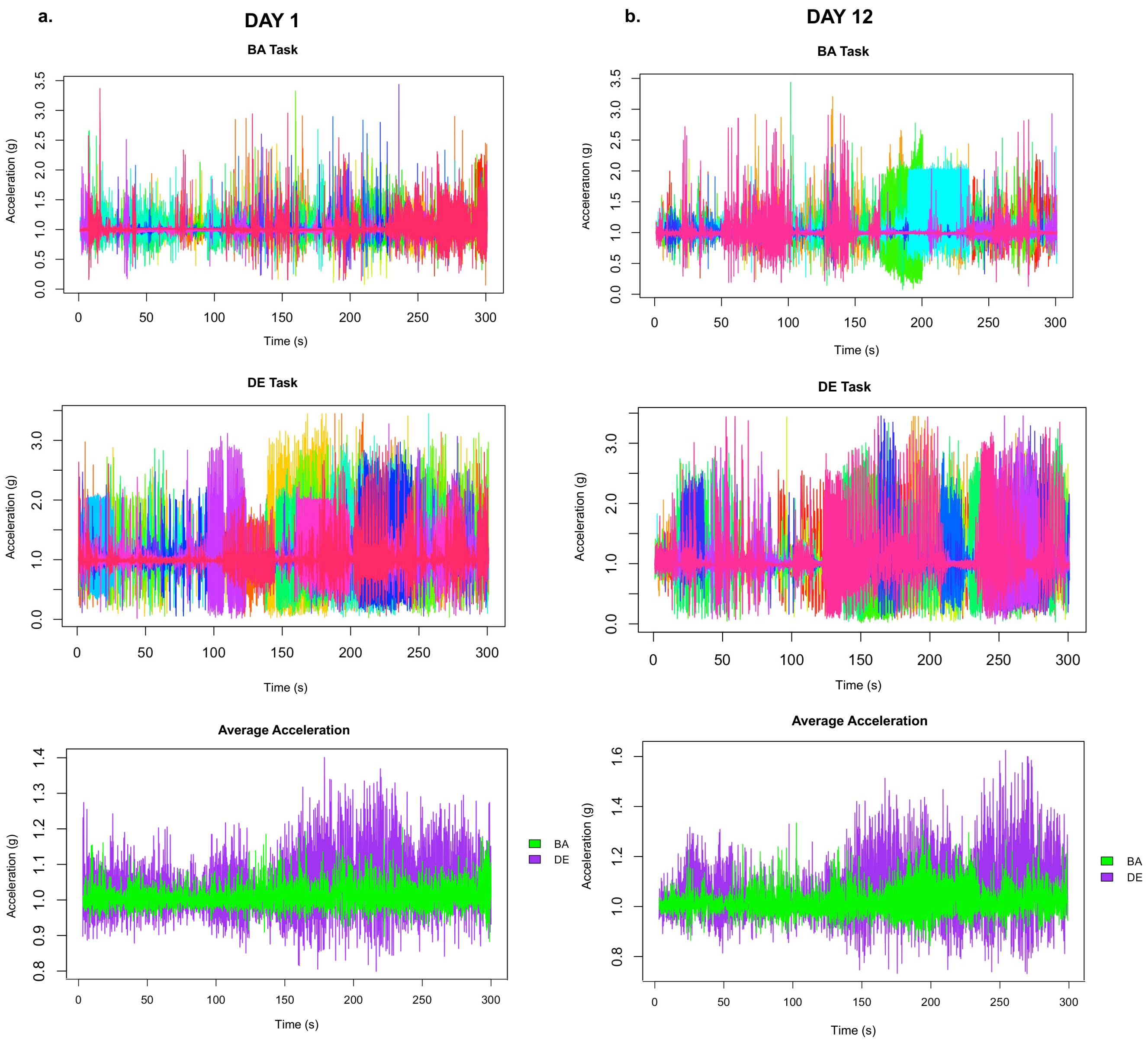
The first 30 seconds of the BA task on Day 1 of at-home completion was used as a measure of baseline heart rate and therefore a proxy for fitness level. A lower resting heart rate most often indicates a higher level of physical fitness (Laskowski, 2020). The first 30 seconds of the BA task involves finding a comfortable standing position and beginning to notice the body in space, which should be comparable to the participant sitting or standing at rest. With this, we are interested in exploring if this baseline heart rate, and therefore proxy for fitness level, has any correlation with changes in symptom scores. For this particular analysis we are including DDD participants only (*n*=13), since we are interested here in looking at heart rate in relation to symptom change. To assess this, a Pearson correlation was run between this baseline heart rate and change scores for DD symptoms (difference in scores on the CDS between Week 1 – Week 3) across these individuals for both tasks. These associations were nonsignificant in the case of both tasks: DE, $r(11) = .08$, $p = .80$ [95% CI = -.50, .60]; BA, $r(11) = -.12$, $p = .70$ [95% CI = -.63, .46]. So, baseline HR, or general fitness level, doesn't seem to make a difference with regards to degree of symptom change with either dance task.

Acceleration

Figure 6.15a depicts individual acceleration profiles of participants on Day 1 (*n*=15) of the tasks. Acceleration was sampled across 3 axes (x, y, z) and measured continuous gravitational force (g) applied to each dimension throughout task performance. A composite measure of these three dimensions was computed, providing an overall measure of movement across the task. Across this 5-minute period, average movement levels were higher, $t(14) = -3.25$, $p = .006$, $g = 1.18$, with the DE task (M=1.04, SD=.03) as compared to the BA task (M=1.01, SD=.02). This shows that the DE task involves more movement than the BA task, also corresponding to the higher average HR seen above.

Figure 6.15b depicts individual acceleration profiles of participants on Day 12 (*n*=10) of the tasks. Across this 5-minute period, average movement levels were again significantly higher, $t(9) = -2.40$, $p = .04$, $g = 1.26$, with the DE task (M=1.06, SD=.04) as compared to the BA task (M=1.02, SD=.02). The DE task involved more body movement than the BA task, which remained consistent at Day 12.

Figure 6.15 Individual and average acceleration profiles across participants on Day 1 (*n*=15) and Day 12 (*n*=10).



Notes. BA = Body Awareness task; DE = Dance Exercise task.

Relationship between amount of movement and symptom change

Within the same 5-minute window on Day 1 and Day 12 of task performance, we also wanted to examine whether there was a relationship between the amount of movement actually performed during the tasks, and symptom change. Simply, is there a correlation between more overall movement during the tasks and a greater reduction in CDS scores? Again, we have included DDD participants only for this analysis as we are interested in movement in relation to symptom change. On both Day 1, DE: $r(10) = .19$, $p = .55$ [95% CI = -.43, .69]; BA: $r(10) = .15$, $p = .64$ [95% CI = -.46, .67], and Day 12, DE: $r(7) = .09$, $p = .81$ [95% CI = -.61, .71]; BA: $r(7) = .19$, $p = .62$ [95% CI = -.54, .76], these associations were nonsignificant in the case of both tasks. This suggests that the amount a participant moves throughout the task does not make a significant difference with regards to the degree of symptom change with either dance task.

6.4.8 Qualitative comments

Finally, we explored the qualitative, open comments provided by the DDD group at the end of the study process. The comments help to highlight individual participants' experience of, and preference for, the BA or the DE task. One participant found specific benefits from both tasks and reported enjoying them equally: with the BA task they "noticed a small decrease in the intensity of depersonalization symptoms... due to the activity helping me focus on the present moment and stopping any mind chatter," whereas with the DE task they "found this exercise really helped ground me and I felt more connected to my body and the surrounding environment." Other participants also found the DE task beneficial, reporting that, compared to the BA task, the DE task "had more of a positive effect. It helped me feel more awake in my body and mind. Afterwards I would feel in a better mood and more grounded, more present in the space." Another participant pointed out that, with the DE task, "having to think about the steps and see your body follow them really seemed to have a strong effect in bringing my mind back to my body, re-connecting it," and a third participant mentioned that after completing the DE task, they “felt that the room was clearer, and objects had more density.” On the other hand, some DDD participants preferred the BA task, reporting “an overall meditative effect which helped to unwind and focus on the present” and making them “more grounded and aware of my physical body and space for a short period after the task.” The BA task was also reported as “relaxing” by some participants, as well as easier to follow along with than previous mindfulness exercises they had tried before, with some immediate effects alongside “longer term benefits over the week compared to when I didn’t do it.”

Similar to the online study in Chapter 5, a number of participants with DDD also reported enjoying a combination of the two tasks: the warmup of the BA task and the main sequence of the DE task. Though a higher proportion of participants with DDD reported experiencing benefits from and enjoying the DE task more, specific, and important benefits from the BA task should not be discounted. These comments also help to highlight task differences and some of the possible reasons why the tasks lead to the symptom reductions that we have seen. Overall, individual differences in these open comments were striking and show the importance of tailoring tasks to the specific needs and symptoms experienced by each person with this condition.

6.5 Discussion

In this study, we developed two dance/movement tasks with the aim of reducing bodily detachment in DDD: one to promote explicit bodily awareness (BA) and the other to implicitly enhance the salience of bodily signals (DE). We then tested whether these tasks could reduce symptom severity and improve mindfulness, interoception across three domains, proprioceptive accuracy, and temporal precision in a group of individuals with DDD compared to clinically healthy controls. This study involved a combination of self-report and behavioural measures. Overall, the results point to the efficacy of dance in reducing DD symptoms in this disorder.

In the DDD group, significant reductions in symptom severity, both overall and on the anomalous bodily experiences subscale, were seen with the performance of both dance tasks over a two-week period. This was observed with both the trait symptom scores (CDS), and with state symptoms (daily Diary Sheet). Consistent with the online study, the healthy control group exhibited a floor effect with no changes in DD symptoms seen, due to already low baseline scores. Taking the opportunity to pool the online and in-person samples together, the same results were seen in that both dance tasks significantly reduce symptom severity in the DDD group across the study period. As suggested in Chapter 5, dance exercise may help individuals with DDD to shift their attention away from the experience of this disorder whilst at the same time increasing sensations within the body and helping to ground them in the present, both internally within their body, and externally with their surroundings. On the other hand, body awareness may allow for a clear, guided focus on the body, promoting a non-judgmental ability to experience, pay attention to, and verbalize bodily sensations. The data collected with the Empatica E4 wrist sensors helps to solidify the proposed physiological differences across the time course of the two tasks. Across a 5-minute window of task performance, the DE task leads to a higher average heart rate and the generation of more body movements as compared to the BA task. So, while there are clear task differences in how aerobic they are, this does not translate to the effectiveness of the task. However, as previously described by Simeon (2004), some individuals with DDD may experience either consistently high or low states of arousal. This makes the case for individual symptom profiles and subtypes within the broader DDD population (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021) being taken into consideration when determining the most effective treatment plan. In this sample, baseline heart rate, which may be representative of a person's fitness level, did not make a difference with regards to the degree of symptom change with either task.

In the DDD group, mean interoceptive awareness, interoceptive accuracy, and interoceptive sensibility did not significantly improve after two weeks of performing either task. Further, reductions in DD symptom severity were not associated with improvements in interoceptive awareness or interoceptive accuracy, in contrast to what was seen with the online study in Chapter 5. Contrary to what would have been predicted, after the body awareness task, more severe DD symptoms were actually associated with higher scores on the Noticing dimension of the MAIA-II. It is possible that being asked in such an explicit way to pay attention to the body, versus shifting attention away from bodily sensations, may be a more challenging experience for those with DDD and actually cause them to unhelpfully notice or ruminate on their symptoms (Hunter, Salkovskis, & David, 2014). These results could also be linked to body vigilance. Though neither task significantly altered levels of body vigilance in the DDD group, scores trended towards increasing with the BA task and decreasing with the DE task. This brings us back to the importance of differentiating between adaptive and maladaptive forms of interoceptive or self-focused attention (Trevisan, Mehling, & McPartland, 2020). It is possible that, depending on the individual, the BA task requires too much of a focus on the body resulting in an unhelpful overanalysis of sensations being felt (or not felt).

Consistent with the online study reported in Chapter 5, at baseline, DDD participants exhibited significantly lower interoceptive awareness and mindfulness compared to controls, though no significant differences between the two groups were found with regards to interoceptive accuracy or interoceptive sensibility. These differential results suggest a disconnect between the dimensions of interoception, replicating previous results reported in DDD (Michal et al., 2014) and reinforcing the need for interoception to be consistently examined as a multi-dimensional framework (Suksaslip & Garfinkel, 2022). This disconnect is further supported by the lack of association seen between changes in interoceptive awareness and interoceptive accuracy, though changes in interoceptive awareness were positively linked to changes in interoceptive sensibility with the DE task only, and changes in interoceptive accuracy were positively linked to changes in interoceptive sensibility with the BA task. Interoceptive sensibility (confidence ratings) may be able to tap into more present state beliefs (Garfinkel et al., 2015; Suksaslip & Garfinkel, 2022). This combination of being self-report (like the MAIA-II) but measuring present state beliefs (like the heartbeat detection task) could be why this measure, specifically, has associations with both interoceptive awareness and interoceptive accuracy in this study. Beyond the DDD group, in contrast to the online study, interoceptive awareness did not significantly improve in the control group after performing both tasks.

In both the DDD group and control group, although mindfulness scores improved after performing both tasks, these improvements did not reach statistical significance for either task. However, in the case of the BA task only, as mindfulness improved, both overall DD symptom severity and anomalous bodily experiences decreased in the total sample and in the DDD group alone. More specific associations between DD symptoms and mindfulness were seen across dimensions of acting with awareness and non-judging, with reductions in symptoms tied with improvements on these two dimensions in the DDD group. This aligns with research evaluating body scanning techniques (Gibson, 2014; Gibson, 2019), and meditation and mindful yoga (Sauer-Zavala, Walsh, Eisenlohr-Moul, & Lykins, 2012), wherein participation in these practices leads to an increase in both mindfulness and interoceptive awareness (Gibson, 2019). A recent study empirically examining the relationship between depersonalization and mindfulness facets (Levin, Gornish, & Quigley, 2022) found the same negative association between DD symptoms and both of these facets (acting with awareness and non-judging) in a nonclinical population. It appears fundamental in body awareness practices to promote a non-judgmental observation of experience (Levin, Gornish, & Quigley, 2022), which may be something that the BA task can help participants tap into. Consistent with the online study, overall improvements in mindfulness were linked with improvements in interoceptive awareness, in the total sample and both participant groups separately, further implying that these two processes are linked.

With regards to proprioceptive accuracy, a significant difference between the two groups was seen at baseline in the visual condition only, though we also see a medium effect with the visual and proprioceptive condition (g = .51), indicating less proprioceptive accuracy in the DDD group as compared to controls. It is possible that this is tied to visual imagery deficits. Previous research has shown a reduced ability to vividly visualize scenarios in DDD (Lambert et al., 2001; Millman, Hunter, David, Orgs, & Terhune, 2022), with a trend towards this also being the case in our current sample (g = .76). The experience of visual distortions in DDD, and dissociation more broadly, are common (Sierra & Berrios, 2001; Lipsanen, Lauerma, Peltola, & Kallio, 1999), so it may be the case that when solely working with the visual domain, the endpoint matching task becomes more difficult. Neither task enhanced proprioceptive accuracy across the study period, and in the visual condition alone of the endpoint matching task, proprioceptive accuracy actually slightly worsened (larger matching error) in the second week of performing both tasks. As this was seen across all participants, and also trended towards being the same in the visual and proprioceptive condition, it is possible that the task was quite difficult, and participants' effort declined over time. Further, the reduction in symptoms seen in those with DDD, across both tasks, was not linked to changes in proprioceptive accuracy.

Contrary to our hypotheses, at baseline, individuals with DDD displayed superior temporal precision as compared to controls, with the two groups exhibiting no significant difference in colour precision. Although this seems odd given the reports of distorted experiences of time or temporal disintegration seen in DDD (Simeon, Hwu, & Knutelska, 2007; Ciaunica, Pienkos, Nakul, Madeira, & Farmer, 2022), there may be a few possible explanations. Firstly, it is possible that the temporal bisection task is more sensitive than the colour task to effort differences. For example, the DDD group might have perceived this task to measure their symptoms in a particular way and therefore put in greater effort or more focus in order to demonstrate the absence of a pathological deficit, leading them to outperform controls at baseline. Based on our examination of baseline accuracy in both the time and colour tasks in the two participant groups, it appears that the level of difficulty of the task did not play a role in the observed group difference in temporal precision. Secondly, although Simeon, Hwu, and Knutelska (2007) have shown increased temporal disintegration in DDD patients relative to controls, alongside positive correlations between dissociative symptoms and temporal disintegration, they also found that the only significant predictor of temporal disintegration scores was dissociative absorption. Therefore, it may be that distorted experiences of time in DDD are present only in individuals with higher levels of absorption, and less so if the symptoms are more purely depersonalization and derealization. Future research exploring time perception in DDD should include the DES, for example, to assess levels of absorption alongside depersonalization-derealization to help better understand this phenomenon.

Finally, a handful of studies have shown that highly dissociative individuals exhibit superior working memory (Chiu, 2018; de Ruiter, Elzinga, & Phaf, 2006; Elzinga et al., 2007). Although this may be less likely in our case given that the DDD group did not outperform controls on the colour task, and the colour task is included to act as a control for attention and working memory differences between groups (Ciullo et al., 2018; Coull, Hwang, Leyton, & Dagher, 2012), it is important to consider this perspective. Working memory capacity has been shown to be important to, and required for, the perception of time (Ustun, Kale, & Cicek, 2017; Lee & Yang, 2018; Pan & Luo, 2011), although timing "cannot be reduced to working memory processes or vice versa" (Droit-Volet & Hallez, 2019, p. 1503). In a group of nonclinical individuals, Chiu (2018) found that those experiencing high dissociation proneness displayed better performance in updating working memory. Along these lines, de Ruiter, Elzinga, and Phaf (2006, p. 116) have suggested that highly dissociative individuals "are characterized by heightened levels of attention, working memory and episodic memory." Further, during performance of a verbal working-memory task, Elzinga et al. (2007) found that both patients with dissociative disorders and healthy controls displayed activation in brain regions that are normally involved in working memory, but it was the patients who showed heightened activation alongside making fewer errors across the task, even though they reported less concentration and higher anxiety throughout. This points towards the possibility that dissociation may actually be linked with superior working memory capacities. The repeated measures correlations suggesting that better temporal precision is associated with more severe symptom scores across performance of the BA task do align themselves with the studies presented above.

Beyond the baseline scores, neither dance task seemed to significantly alter levels of temporal precision in the DDD group, though this appeared to improve overall in controls across time, possibly as a result of practice. A study by Bueti et al. (2012) indeed revealed that the visual learning of time is linked with structural and functional changes in the brain that “correlated with changes of performance accuracy,” (p. 725) suggesting an effect of training or practice on the learning of time. In the context of these results, it is important to note the possibility that the self-reported timing distortions in DDD may be at a different time scale to that depicted in the temporal bisection task, so this particular task may not tap into the type of temporal distortions that they experience. More importantly, the temporal distortions reported in DDD might also be metacognitive in nature wherein they perceive themselves as having an altered experience of time, but their time perception is actually ‘normal’ or superior, suggesting that they could have a metacognitive deficit paralleling that observed in functional cognitive disorder, for example (Bhome, McWilliams, Huntley, Fleming, & Howard, 2019; Bhome et al., 2022). This possibility could be tested with the inclusion of confidence judgments during perceptual tasks. Interestingly, though not significant, there was a trend towards the DDD group displaying larger bisection point (perceived duration/temporal bias) values at baseline, suggesting a tendency to underestimate temporal intervals. This reinforces the possibility that these individuals may experience some type of cognitive perceptual deficit that may also be tapped into with the inclusion of self-report confidence judgments.

6.6 Limitations

Despite the novelty and strengths of this study, the interpretation of the results should be framed by the limitations of the study. The first limitation of this study is our COVID-induced, underpowered sample size. This makes it more difficult to determine if the outcomes seen in this study are reliable and robust, and simultaneously reduces our chances of detecting a true effect. It would have been particularly beneficial to compare equal samples across the online and in-person studies presented in this thesis. Of course, future in-person work in this arena, not during the height of a global pandemic, should aim for the inclusion of larger samples.

Technological difficulties, particularly with the Empatica E4 sensors, led to large amounts of missing data across the at-home period. In retrospect, it would have been useful to have participants wear the sensor at the first in-person session, when they were taught one of the two dance tasks, to ensure that data was successfully collected for all participants on this day. In future studies with larger samples, this is an easy fix to make, along with the inclusion of similar technology that is, for example, already integrated into smartphones, providing an ease of access and less of a steep learning curve for participants.

As mentioned in Chapter 5, we did not include a no-intervention control group due to our interest in comparing two very different methods of actively engaging with the body in this population. This means that our findings could be potentially explained by mere spontaneous symptom improvements, regression to the mean, or other therapeutic interventions, including medication or talk therapy, over time. However, any observed task differences imply that the reductions in bodily detachment are indeed linked to the performance of one or both of these two tasks, rather than time passing or individuals with DDD simply working with someone who cares about their condition.

Though a consistently used and previously well-validated measure of interoceptive accuracy (Schandry, 1981; Dunn et al., 2010), the heartbeat counting task has fallen under a lot of criticism in recent years with respect to its reliability and validity (Hickman, Seyedsalehi, Cook, Bird, & Murphy, 2020; Desmedt, Luminet, & Corneille, 2018). Recent work has shown that performance on this task can be impacted by prior beliefs about one’s heart rate (Kleckner, Wormwood, Simmons, Barrett, & Quigley, 2015), resulting in task performance remaining relatively stable over time (Ring & Brener, 2018). The development of novel interoception tasks, like the Phase Adjustment Task (Plans et al., 2021), that help to tackle some of these methodological issues, is a promising way forward. Future research examining interoception in DDD and other populations experiencing interoceptive deficits should aim to include these more accessible, reliable, and valid methods of interoception. Beyond working with more up-to-date, reliable measures of interoceptive accuracy, it is important that future research moves beyond cardiac interoception to include the assessment of other bodily axes like respiratory and gastric interoceptive accuracy (Suksaslip & Garfinkel, 2022).

A final limitation of this study is the lack of follow-up measures. It would be both insightful and interesting to assess whether or not participants continued to perform one or both of the tasks, or if they integrated another form of physical activity into their daily life. An assessment of their symptoms at 3- or 6-months post-study would also help to determine the possible longer-term effects of these tasks.

6.7 Conclusions

Consistent with the online study presented in Chapter 5, we conclude that dance and movement can be used as an effective and bespoke tool to help reduce dissociative symptom severity in DDD while promoting an active engagement with the body. Dance uniquely allows for the development of interventions that use bodily movements to first inform the body, *generating* bodily experiences rather than reflecting on their disruption, and addressing deficits in interoception and mindfulness in the process. Future research examining the role of the body as well as metacognition in this clinical population is required to help better understand why these tasks may work, and also compare them to other forms of exercise or body-based interventions. Beyond this, the continued development of disorder- or symptom-specific dance/movement interventions is also needed, particularly for other conditions involving symptoms of dissociation and abnormal or deficient interoceptive processing.

7. General Discussion

7.1 Summary of the main findings

Fundamentally, we are embodied beings. In DDD this sense of embodiment is disrupted, reflected in symptoms of detachment and disconnection from the self, body, and reality (Simeon & Abugel, 2006). The aim of this thesis has been to generate a better understanding of DDD, both more broadly as a heterogeneous clinical condition, and more specifically from the perspective of the body, presenting the usefulness of dance/movement interventions for DDD.

Throughout this thesis, I have explored DDD from multiple angles, presenting encouraging, novel research in this clinical population, as well as in the realm of dance movement therapy. Chapter 2 presented a systematic review of DMT for mental health, bringing to light the clinical efficacy of these types of interventions, alongside a need for a better understanding of the mechanisms underlying them. This review was written with a goal of moving towards the inclusion of cognitive neuroscience research on embodiment and interoception within DMT research more broadly.

Chapter 3 presented a latent profile analysis of DDD patients, yielding evidence for five distinct subgroups within this population: three reflecting differential general severity levels, and two differing primarily on detachment and compartmentalization dissociative symptomatology. These results suggest that symptom heterogeneity in DDD may be attributable to discrete symptom subgroups with implications for the mechanisms, treatment, and aetiology of this condition. Verbal suggestibility in DDD was the focus of Chapter 4, with results revealing that individuals with DDD and demographically matched controls did not significantly differ with regards to suggestibility, with Bayesian evidence for the null hypothesis that patients were not higher in suggestibility than controls. So, unlike other dissociative disorders typically denoted by compartmentalization symptomatology (Spiegel et al., 2013), DDD does not appear to be characterized by elevated direct verbal suggestibility.

The second section of this thesis was focused on the use of dance and movement as a route to reduce the severity of DD symptoms whilst improving a sense of bodily awareness in DDD. Chapter 5 presented an online study revealing that both types of dance tasks reduced symptom severity, including anomalous bodily experiences, in individuals with DDD, though dance exercise was perceived to be less difficult. Interestingly, only the dance exercise task increased mindfulness in the DDD group, while only the body awareness task increased mindfulness in controls, and reductions in symptom severity were linked with improvements in mindfulness and interoceptive awareness in the DDD group. Chapter 6 presented an in-person study, again revealing the efficacy of dance in reducing symptoms, both overall and anomalous bodily experiences, in DDD. Further, at baseline, DDD participants exhibited superior temporal precision alongside significantly lower interoceptive awareness, mindfulness, and proprioceptive accuracy, compared to controls, though no significant differences between the two groups were found with regards to interoceptive accuracy or interoceptive sensibility.

This thesis has broadened our understanding of DDD, shedding light on the diverse symptomatology within this clinical population and further uncovering its relationship to other dissociative disorders. Beyond these important findings, the two final studies excitingly point towards the overall effectiveness of dance and movement in reducing symptoms in DDD whilst improving a sense of body awareness. Though implications and limitations of this work have been discussed throughout the body of the thesis, the following sections will integrate these findings along with bringing forward suggestions for future directions of research.

7.2 Implications

The research presented in this thesis has a host of implications for the treatment of DDD. Firstly, the identification of latent subgroups in DDD (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021), characterized by differential profiles of dissociative symptomatology, suggests the need for a careful and thorough assessment of these individuals to determine a catered and integrated treatment plan. The discovery of latent subgroups has been very important in the case of PTSD, for example, where reliable evidence was found for a dissociative subtype (Lanius et al., 2010; Steuwe, Lanius & Frewen, 2012; Lanius, Brand, Vermetten, Frewen & Spiegel, 2012; Wolf et al., 2012; Blevins, Weathers & Witte, 2014), now independently recognized in the DSM-5 (American Psychiatric Association, 2013). This subtype is characterized by differential symptoms, comorbidities, and precipitating factors (Wolf et al., 2012; Steuwe, Lanius & Frewen, 2012), therefore having clinical implications for treatment and prognosis.

Now that we have results showing variability in the expression of DDD, the treatment regimen prescribed to each individual should take into consideration the role that particular comorbidities and psychiatric symptoms may play in the onset and maintenance of their DDD. The effectiveness of the two dance/movement tasks presented in Chapter 5 and Chapter 6, for example, may map onto the subgroups determined in Chapter 3 (Millman, Hunter, Orgs, David, & Terhune, 2021). Although we found that individuals with DDD and demographically matched controls did not significantly differ with regards to suggestibility (Chapter 4; Millman, Hunter, David, Orgs & Terhune, 2022), the possibility remains that an elevated level of suggestibility may be present within, and specific to, certain subgroups of this disorder that experience heightened levels of compartmentalization symptoms, like the High dissociation class. Though the body awareness task (Chapter 5 and Chapter 6) works with the physical body and its sensations, it also relies heavily on the use of visual imagery. As we have seen in Chapter 4 and Chapter 6 (with trends towards the same result in Chapter 5), as well as in previous research (Lambert et al., 2001), individuals with DDD exhibit a reduced ability to vividly visualize scenarios compared to controls. Related to this, there is evidence that those individuals with poorer imagery capacity are also less responsive to suggestion, implying that some imagery capacity may be necessary, but not sufficient, to respond to suggestions (Terhune and Oakley, 2020; Sheehan and Robertson, 1996). Therefore, it may be the case that the High dissociation subtype within DDD not only experience more compartmentalization symptoms, but they may also exhibit superior visual imagery alongside heightened levels of suggestibility. This presents the possibility that the BA task, with its use of imagery and explicit noticing of sensations, may be more effective for individuals with this symptom profile. Those DDD patients who have poorer visual imagery and lower suggestibility may find the BA task too challenging, therefore reducing its potential effectiveness. On the other hand, patients experiencing higher levels of more classic DDD detachment symptoms (High depersonalization class) may find treatments focused on grounding and alleviating feelings of disembodiment (Hunter et al., 2005; Nestler et al., 2015) the most effective. In the case of our dance tasks, it is possible that the dance exercise task, which does not involve the use of visual imagery or imagination, may provide a greater benefit. The generation of more body movement and a higher heart rate through use of this aerobic and more physically demanding task, leading to increased bodily sensations, may better help to ground these individuals in the present, both internally within the body (depersonalization) and externally with their surroundings (derealization).

Beyond the dance tasks used in Chapters 5 and 6, the latent classes (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021) are also likely to differentially respond to more traditional DMT treatments. For example, the High depersonalization subtype may find the use of percussive rhythms, dance, and song that are involved in *primitive expression* (Margariti et al., 2012) to proactively engage with and ground their body in the present time and space. This again may be in contrast to the High dissociation subtype that would perhaps be more responsive to a technique such as *authentic movement* (Whitehouse, 1999), involving paying attention to sensations, images, and emotions, and giving these a new form through movement. All of this is to make clear that it is of essential importance to not only thoroughly assess and diagnose someone with DDD, but it needs to move beyond this broad diagnosis into the determination of individual differences and heterogeneity. This would allow for the most appropriate type of intervention to be paired with an individual's symptom profile and increase the likelihood of a good treatment outcome.

The finding of superior temporal precision at baseline in the DDD group as compared to healthy controls (Chapter 6) may also be tied into the experience of particular psychiatric symptoms within the broader DDD diagnosis. Previous research revealing that the only significant predictor of temporal disintegration scores in DDD was absorption (Simeon, Hwu, and Knutelska, 2007) suggests that those individuals with higher compartmentalization scores may be the most susceptible to distortions of time. The possibility that working memory may also be involved in this process (Chiu, 2018; Ruiter, Elzinga, & Phaf, 2006; Elzinga et al., 2007) means that a future study including measures of temporal precision, working memory, depersonalization-derealization symptoms, and dissociative symptoms more broadly is necessary to better understand the role of temporal precision in DDD, with implications for treatment.

The investigation of the role of the body in DDD within this thesis has revealed the importance of this consideration. At baseline, the observation of lower mindfulness (Chapter 4; Millman, Hunter, David, Orgs & Terhune, 2022; Chapter 5 and 6) and interoceptive awareness (Chapter 5 and 6), as well as reduced proprioceptive accuracy (Chapter 6) in DDD participants compared to clinically healthy controls reinforces the prediction that these individuals experience their bodies differently and implies a role of these abilities in the maintenance of depersonalization-derealization symptoms. If the individual is able to essentially reintegrate with their body, their likelihood for depersonalization-derealization symptom reduction increases (as seen with the repeated measures correlations presented in Chapter 5).

Explorations of the facets of mindfulness and dimensions of interoceptive awareness reveal that the dance tasks developed for these studies may work via different mechanisms. Including questionnaires like the FFMQ (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006) and MAIA-II (Mehling et al., 2018) within a patient's diagnostic interview battery would help determine where any particular deficits lie, allowing again for the explicit and specific tailoring of the dance/movement therapy. For example, whereas dance exercise appears to encourage a sense of comfort (FFMQ-Non-Judging) and trust (MAIA-Trusting, FFMQ-Observing) within the body, body awareness may be better at promoting a specific type of paying attention to the body (MAIA-Body Listening, FFMQ-Non-Reacting) and an ability to verbalize bodily sensations (FFMQ-Describing). Again, it may be that the High depersonalization class, experiencing more severe detachment symptoms, or the High severity class, with heightened overall symptoms including those of anxiety (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021), would benefit the most from improvements in trusting and non-judgmentally observing the body. This is in contrast to the High dissociation class, experiencing more severe compartmentalization symptoms as well as the possibility of heightened suggestibility and the ability to vividly visualize scenarios, wherein proactively listening to the body and being able to describe the sensations that are occurring within it, whilst simultaneously not negatively reacting to these sensations, could be a more effective form of treatment. The use of dance and movement is a vast and exciting new avenue for treatment and therapy in this population, as the novel studies presented in Chapters 5 and 6 suggest. As discussed above, the ease with which these therapeutics could be tailored to address specific components of mindfulness and interoceptive awareness really makes them an untapped resource for this population and perhaps other symptom-adjacent disorders.

Whereas going on a run may induce a dissociative attentional style, wherein the individual shifts their attention away from their body and its sensations (Bigliassi, Karageorghis, Nowicky, Wright, & Orgs, 2017), both of the dance tasks used in Chapter 5 and Chapter 6 appear to promote an adaptive, associative attentional style (Gibson, 2019), but are likely to achieve this in different ways. The improved mindfulness seen in those with DDD after the dance exercise task (Chapter 5) may be due to the performance of simple movements and aerobic exercise shifting attention away from the experience of DDD, whilst simultaneously increasing bodily sensations, helping to ground the individual in the present moment. On the other hand, the body awareness task may allow for a clear, guided focus on the body, promoting an ability to describe, experience, and pay attention to, bodily sensations. However, it is important to note that for some individuals, too much of an explicit focus on bodily sensations could be maladaptive. The BA task may be broadly more challenging for those with DDD due to the explicit instruction to focus on bodily experiences and, depending on the individual, may result in an unhelpful overanalysis of sensations being felt (or not felt). There appears to be a fine balance between positively attending to the body and paying too much attention to it (Trevisan, Mehling, & McPartland, 2020). An adaptive, helpful shift in attention that maintains this balance could perhaps be targeted in other forms of therapy too, from CBT to psychodynamic therapies, and even to virtual reality environments (Patrikelis et al., 2021).

Beyond these important clinical implications, the discovery that both dance tasks improved interoceptive awareness, and the body awareness task improved mindfulness, in controls (Chapter 5), reveals the usefulness of dance/movement in the general population more broadly. This lines up with and adds to the previous research base showing physical and psychological wellbeing benefits of dance or body-based activities in non-clinical samples (Koch, Kunz, Lykou, & Cruz, 2014; Akandere & Demir, 2011; Eyigor, Karapolat, Durmaz, Ibisoglu, & Cakir, 2009; Meekums, Vaverniece, Majore-Dusele, & Rasnacs, 2012; Alpert, 2011), and broader knowledge that physical exercise in general has a host of health benefits (Warburton, Nicol, & Bredin, 2006).

7.3 Limitations

The focal point when determining the DDD samples within this thesis was ensuring that all included individuals met clinical diagnostic criteria for DDD. However, an important consideration for the studies presented in Chapters 3 – 6 is that a formal assessment for the presence of other dissociative disorders, such as dissociative amnesia or DDNOS, was not included in the screening process. It is true that symptom overlap exists between DDD and other dissociative disorders and it would be a worthwhile consideration in future research exploring symptom heterogeneity (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021), verbal suggestibility (Chapter 4; Millman, Hunter, David, Orgs, & Terhune, 2022) or intervention options (Chapter 5 and 6) for this clinical group. This would allow for a better parsing out of the differences among dissociative disorders in relation to a range of questions.

Within the studies presented in Chapters 4 – 6, it would have been useful to include a broader measure of dissociation, like the Dissociative Experiences Scale (DES, Carlson & Putnam, 1993), to help determine where these DDD samples fall within the five subtypes presented in Chapter 3 (Millman, Hunter, Orgs, David, & Terhune, 2021). This would allow for a more concrete understanding of which dance task is most effective for these differential symptom profiles and should be included in future research.

Though the in-person intervention study reported in Chapter 6 worked to include both self-report and behavioural measures, the rest of the investigations presented in this thesis, beyond the systematic review (Chapter 2; Millman, Terhune, Hunter, & Orgs, 2020), included only self-report. Some of this was due to working with a large, pre-determined dataset (Chapter 3; Millman, Hunter, Orgs, David, & Terhune, 2021), and some was due to ethical requirements that studies be conducted fully online during the COVID-19 pandemic (Chapter 5). As stated throughout this thesis, it is both important and necessary for future research in the field of DDD and DMT to continuously include more neurophysiological and contemporary cognitive neuroscience methods that provide rigorous and reliable assessment. This would only benefit and better our understanding of the mechanisms at play in this, still vastly understudied, clinical condition.

Given the time frame as well as the design of the intervention studies (Chapter 5 and 6), formal follow-up measures were not included. To get a gauge on whether or not the symptom reductions that we have observed remain in the longer term, as well as determining whether or not individuals with DDD actually continue to perform daily or weekly tasks engaging with the physical body, a formal follow-up assessment at 3- or 6-months would be invaluable and should be the aim for future research.

The inclusion of two active conditions without a no-intervention control group (Chapter 5 and 6), due to my interest in first comparing two very different types of actively engaging with the body in this population, could mean that the results have explanations beyond participation in the tasks. However, the task differences that we see emerge, in both the online and in-person studies, do suggest that the reductions in bodily detachment and improvements in mindfulness and interoceptive awareness are indeed linked to the performance of one or both tasks. Beyond this, insofar as suggestibility may predict placebo responding (Parsons, Bergman, Wiech, & Terhune, 2021; Corsi & Colloca, 2017), and we did not see elevated suggestibility in this DDD population, it becomes even more likely that any symptom reductions or bodily awareness improvements are not simply placebo responses. It is important that these studies are replicated with the inclusion of a no-intervention group alongside these two interventions to confirm the reported findings and better understand the mechanisms behind the movement.

7.4 Future directions

This thesis has opened up a range of avenues for future research in DDD and symptom-adjacent disorders. Within the latent profile analysis presented in Chapter 3 (Millman, Hunter, Orgs, David, & Terhune, 2021), patient's subjective reports of factors that precipitated their DDD symptoms were not strong discriminators among the five classes. However, these reports can be of great benefit to better understand a patients' *perception* of their symptom origin, which may play an important role in their experience and management of the disorder (Petrie & Weinman, 2012). Previous research in DDD has suggested that DDD triggers can range from severe stress, to the consumption of drugs including hallucinogens or marijuana, a traumatic event, or panic (Hunter, Charlton, & David, 2017). Future research should aim to conduct a more widespread, qualitative study exploring DDD triggers to get a continued and better understanding of what emerges as the most commonly reported precipitating factors, and whether or not the perception of what triggered symptom onset then has an impact on the nature or degree of symptoms experienced within this disorder. This knowledge would allow for the further tailoring of treatments and could also become a target within the treatment itself.

As mentioned in both Chapter 3 (Millman, Hunter, Orgs, David, & Terhune, 2021) and Chapter 4 (Millman, Hunter, David, Orgs, & Terhune, 2022), the relationship between depersonalization-derealization and anxiety is complex. Future research to better unpack this relationship will require a wider range of anxiety measures that explore both specific anxiety symptoms and different forms of anxiety including panic disorder (Segui, Ma'rquez, Garcia, Canet, Salvador-Carulla, & Ortiz, 2000), PTSD (Lanius et al., 2012), and OCD (Soffer-Dudek, 2018). A more robust assessment of anxiety may uncover a DDD subtype characterized by high anxiety but lower depersonalization-derealization (Sierra et al., 2012), which again would have implications for treatment. Beyond this, as the dissociative subtype of PTSD is centrally defined by the experience of depersonalization-derealization symptoms, the inclusion of measures of PTSD symptoms like hypervigilance and flashbacks (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) would help determine if there is, reciprocally, a subgroup within DDD specifically characterized by heightened PTSD symptoms. If there is, it is a possibility that these individuals may also be those whose DDD was triggered by a traumatic event. This would also have implications for the suggestibility results presented in Chapter 4 (Millman, Hunter, David, Orgs, & Terhune, 2022): insofar as elevated direct verbal suggestibility is observed in PTSD (Wieder et al., 2022; Bell et al., 2011; Dell, 2017), and hypnotic suggestibility has been repeatedly shown to positively covary with posttraumatic symptoms (DuHamel et al., 2002; Keuroghlian et al., 2010; Yard et al., 2008), an elevated level of suggestibility may be specific to individuals with trauma-related dissociative symptoms (Putnam et al., 1995). As previously mentioned, the consistent inclusion of a broader dissociative measure like the Dissociative Experiences Scale (DES, Carlson & Putnam, 1993), alongside the DDD-specific Cambridge Depersonalization Scale (CDS, Sierra & Berrios, 2000), in DDD research in general, would help to assess wider dissociative symptomatology in this population as well as its relationship to suggestibility in DDD. The hypothesis that elevated suggestibility is specific to DDD patients experiencing compartmentalization could then be tested. Preliminarily, correlations do suggest that responsiveness to verbal suggestions scales with symptom severity in DDD (Chapter 4; Millman, Hunter, David, Orgs, & Terhune, 2022), implying a link between the severity of symptoms and suggestibility.

The inclusion of the DES would also allow for a better understanding of the relationship between dissociation (compartmentalization), depersonalization-derealization (detachment), and temporal precision. It is imperative that the finding that individuals with DDD exhibit superior temporal precision at baseline compared to controls (Chapter 6) is probed in future DDD and dissociative disorders research. The fact that our samples (Chapter 4; Millman, Hunter, David, Orgs, & Terhune, 2022; Chapter 6) did not exhibit elevated suggestibility, but did exhibit superior temporal precision, suggests that these samples were experiencing high levels of depersonalization-derealization detachment symptoms specifically, compared to compartmentalization-type symptoms including absorption. A future study including measures of temporal precision, detachment and compartmentalization symptoms, and working memory, is required to more clearly understand the role and experience of time perception in DDD and dissociative disorders.

On the basis of previous research pointing towards reduced mindfulness in highly dissociative individuals (Pick et al., 2020; Butler et al., 2019; Michal et al., 2007; Nestler et al., 2015), mindfulness was included as a variable of importance in relation to verbal suggestibility in Chapter 4 (Millman, Hunter, David, Orgs & Terhune, 2022). The observation of a borderline significant negative correlation in the patient group does point to a potential role of lower mindfulness supporting greater responsiveness to suggestion in DDD patients. This finding requires greater attention in future research on DDD, as well as in dissociative disorders and pathology more broadly.

In future intervention research and randomized controlled trials, the inclusion of a clinical control group alongside a DDD group and a clinically healthy control group is important. One route to this would be the use of an anxiety disorders (OCD, panic disorder, GAD, health anxiety) population. Having a direct comparison of response to dance/movement interventions in these two groups would not only be beneficial in directly parsing out the differences and similarities between DDD and anxiety conditions on measures of interoception, mindfulness, proprioceptive accuracy, and temporal precision, but would also provide further insight into the mechanisms behind the interventions. This would especially be the case if the research included two very different types of interventions, as seen in Chapter 5 and Chapter 6 of this thesis. Though one would expect to see beneficial effects in both populations due to the use of engaging with the whole body, these beneficial effects may take shape via divergent routes, differentially altering bodily processes.

This thesis presents a strong case for the use of dance and movement in the treatment of DDD. Given the encouraging results seen in Chapter 5 and Chapter 6, future research should aim towards the continued use of these tasks, or variants of these tasks, in DDD as well as other populations experiencing dissociation or interoceptive deficits including functional neurological disorder (FND; Pick et al., 2020; Koreki et al., 2020), the dissociative subtype of PTSD (Lanius et al., 2012) and alexithymia (Shah et al., 2016). As stated in Chapter 1, the manualization of DMT protocols will not only help to unpack the specific mechanisms at play within the therapy but will also facilitate replication and generalization and improve validity. The tasks used in Chapter 5 and Chapter 6 are a step forward in terms of manualizing dance/movement therapies and do appear to address specific and different components of mindfulness and interoception in DDD, suggesting that they work via different mechanisms. Whereas dance exercise may lead to symptom improvements via enhancing levels of trust and comfort within the body, body awareness may reduce symptoms by promoting an ability to verbalize and proactively pay attention to bodily sensations. The fact that these two standardized tasks appear to have achieved their results through differing mechanisms encourages their use in future DMT work and also makes clear that manualizing treatment does not mean one standard procedure for all types of symptoms. The opportunity for these types of therapeutics to be manualized whilst simultaneously tailored to address specific components of mindful body awareness, as seen in Chapter 5 and Chapter 6, makes them a key resource within DMT and psychotherapy more broadly, and can help to inform future DMT interventions or protocols. The continued development of disorder- or symptom-specific movement-based interventions is an important way forward. Further, both throughout this thesis and in other recent works (Nord & Garfinkel, 2022), the importance of a bottom-up approach to treatment where the individual is reached through their somatic symptoms, with an aim to support both psychological and physiological integration, has been made clear (Pierce, 2014; Jorba-Galdos, 2014; Dieterich-Hartwell, 2017; Koch & Harvey, 2012). Improvements in interoception or body awareness may be central to successful treatment in the conditions mentioned above (Dieterich-Hartwell, 2017).

Though in both the online (Chapter 5) and in-person (Chapter 6) intervention studies, no significant dance task differences were found when evaluating the changes in depersonalization-derealization symptom scores, there is a clear and consistent trend towards the dance exercise task leading to a greater, though not statistically significant, symptom reduction. Beyond this, it was also generally more preferred among individuals with DDD, though the positive reactions to, and benefits from, the body awareness task should not be discounted. This trend towards the more physically demanding, aerobic dance exercise task potentially providing greater benefits in this population does line up with the literature revealing the benefits of physical exercise, more broadly, for mental health (Taylor, Sallis, & Needle, 1985; Mikkelsen, Stojanovska, Polenakovic, Bosevski, & Apostolopoulos, 2017; Chekroud et al., 2018). For example, in a study by Wipfli, Landers, Nagoshi, and Ringenbach (2011), aerobic exercise, compared to a stretching control group, was found to increase blood levels of serotonin in a similar fashion to anti-depressants (Mikkelsen, Stojanovska, Polenakovic, Bosevski, & Apostolopoulos, 2017). It could be the case that aerobically engaging with the body is a key factor in dissociative symptom reduction and may lead to greater benefits overall than other forms of body-based therapies or interventions. It is imperative that this possibility be tested in future studies. One suggestion would be to conduct a study using the two dance tasks presented in Chapters 5 and 6, alongside a pure physical exercise condition such as running. This would help better differentiate and understand the specific effects that may be at play within the dance exercise task. Beyond this, the trend towards the dance exercise task potentially providing greater benefits may be caused by our DDD samples in Chapter 5 and Chapter 6 falling, to a greater degree, into the High depersonalization subtype of DDD described in Chapter 3, as mentioned above (Millman, Hunter, Orgs, David, & Terhune, 2021). As put forward in the implications section, perhaps it is those experiencing more compartmentalization symptoms or heightened suggestibility who would find greater benefit from the body awareness task, and this may not have been as present in our samples. Including measures to differentiate between these ostensible subtypes in future DDD intervention research will be crucial to testing this possibility and better defining the most effective treatments for these subtypes.

Alongside expanding DMT out to more dissociative clinical conditions, or those with an experience of reduced interoception, the inclusion of a combination of behavioural, neural, and self-report methods within this research is essential. Further, interoception should continue to be measured across all dimensions (Suksaslip & Garfinkel, 2022), and be seen as a multi-dimensional framework. As clearly put forward by Nord & Garfinkel (2022), "the nature of interoceptive beliefs and predictions could be key for understanding a variety of neuropsychiatric conditions, particularly when top–down beliefs differ from perceived afferent signals" (p. 506). For these assessments to be as thorough as possible, movement beyond cardiac interoception to the inclusion of other bodily axes like respiratory and gastric, (Nord & Garfinkel, 2022; Suksaslip & Garfinkel, 2022) will be crucial to better understand the bodily axes that may be awry in DDD, as well as the relationship among them.

7.5 Conclusion

This thesis is focused on a clinical population that is still widely underrecognized, underdiagnosed, and undertreated. The novel research presented across these Chapters not only helps to fill gaps in both DDD and DMT literature, but it opens up an abundance of avenues for future research, as discussed above. We can now move forward with a better and broader understanding of DDD, with new light shed on the diverse symptomatology within this clinical population and its relationship to other dissociative and germane disorders. The discovery of latent subtypes present within DDD can allow for the tailoring of treatments specific to these symptom profiles. Beyond this, the two intervention studies encouragingly point towards the overall effectiveness of dance and movement in reducing the severity of depersonalization-derealization symptoms, whilst improving a sense of body awareness, in this clinical population.

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Appendix

A1

Chapter 3 supplementary material

Table A1.
Sample counts (and %) for severity levels of anxiety, depersonalization and dissociation in DDD patients as a function of latent class.

		Low severity (*n* = 79)	Moderate severity (*n* = 90)	High dissociation (*n* = 32)	High depersonalization (*n* = 67)	High severity (*n* = 35)
		n **(%)**	***n*** **(%)**	***n*** **(%)**	***n*** **(%)**	***n*** **(%)**
BAI	**Minimal** (0-7)	9 (11.6)	18 (19.9)	3 (9.4)	11 (16.5)	1 (2.9)
	Mild (8-15)	19 (24)	24 (26.5)	6 (18.6)	17 (25.5)	8 (22.9)
	Moderate (16-25)	27 (32.4)	22 (25)	12 (37.6)	23 (34)	7 (20)
	Severe (26-63)	20 (26.9)	22 (24.2)	9 (28.2)	15 (22.5)	15 (42.9)
CDS	**Mild** (0-70)	54 (68.4)	3 (.03)	6 (18.7)	0 (0)	0 (0)
	Severe (71-290)	25 (31.6)	87 (96.7)	26 (81.3)	67 (100)	35 (100)
DES	**Mild** (0-30)	77 (97.4)	81 (90.1)	3 (9.4)	29 (43.3)	0 (0)
	Severe (30-100)	1 (1.3)	8 (8.8)	29 (90.6)	36 (53.7)	35 (100)

Notes. BAI = *Beck Anxiety Inventory*; CDS = *Cambridge Depersonalization Scale*; DES = *Dissociative Experiences Scale*.

Table A2
Bivariate correlations across the entire sample (N=303) between measures of anxiety, depersonalization and dissociation included in the LPA.

Variable	*M* *(SD)*	BAI	CDS-AB	CDS-EN	CDS-ASR	CDS-AfS	DES-DPDR	DES-AM	DES-AI	CDS-S
BAI	20.25 (12.25)	-								
CDS-AB	37.82 (22.59)	.02	-							
CDS-EN	25.47 (16.87)	.09	.64**	-						
CDS-ASR	19.67 (11.89)	.11	.63**	.59**	-					
CDS-AfS	1.43 (.18)	.04	.52**	.55**	.53**	-				
DES-DPDR	35.50 (21.06)	.13*	.67**	.49**	.52**	.43**	-			
DES-AM	.76 (.53)	.20**	.39**	.36**	.45**	.19*	.52**	-		
DES-AI	29.44 (17.79)	.15*	.49**	.42**	.53**	.34**	.72**	.60**	-	
CDS-S	42.72 (21.96)	.09	.70**	.60**	.62**	.46**	.65**	.41**	.55**	-

Notes. BAI = *Beck Anxiety Inventory*; CDS = *Cambridge Depersonalization Scale*; DES = *Dissociative Experiences Scale*; CDS-AB = CDS *anomalous body experience*; CDS-EN = CDS *emotional numbing*; CDS-ASR = CDS *anomalous subjective recall*; CDS-AfS = CDS *alienation from surroundings*; DES-DPDR = DES *depersonalization-derealization*; DES-AM = DES *amnesia*; DES-AI = DES *absorption and imaginative involvement*; CDS-S = CDS *state*. * p < .05, ** p < .001

A2

Chapter 4, Chapter 5, and Chapter 6 supplementary material

DDD Screening Form

INTERVIEWER:

TELEPHONE SCREENING:
Bodily Awareness and Dance

DATE: TIME:

RESPONDENT INFORMATION

NAME:

GENDER:

CONTACT NUMBER:
EMAIL ADDRESS:

DOMINANT HAND:

AGE:

IF EXCLUDED: CODE _________________

DATE/TIME OF APPOINTMENT ____________________

INTERVIEWER:

AFTER INTERVIEW HAS FINISHED ENTER CODED DATA ON EXCEL SHEET WITH SCREENING ID

STORE THIS PAGE AND SHRED THE REMAINING PAGES

INTERVIEWER:

Screening ID:

INTRO:

Hello, is that______ ?

[If yes]

My name is ______ I am calling from Goldsmiths, University of London because you expressed an interest in a research study we are conducting, looking at bodily awareness and dance. We sent an information sheet about the study - did you have a chance to look at this? Are you still interested in taking part? [If yes] Is it ok to speak for five minutes now?

Thank you, I just need to ask you a few screening questions to see if you are eligible to participate in the study. We ask these questions to everyone who expresses interest. Try to be as honest as possible in answering these questions. I will let you know at the end of the questions whether or not you are eligible and if you are not eligible I will explain why. Okay? Great!

INTERVIEWER:

#	Question	Response	Action
1	*Can I confirm the spelling of your name?* *Thank you.*	NAME	
2	*How old are you?*	AGE:	<18 >70 CODE A1 Exclude
3	*Do you live in the city of London? If not, in which country do you live?*	WHERE:	

<table>
<tr><td>5</td><td>DDD Diagnosis (DSM-5 criteria)

1. Do you have the presence or persistent recurrence of:
A. Experiences of unreality, detachment, or being an outside observer with respect to one's thoughts, feelings, sensations, body, or actions (e.g., perceptual alterations, distorted sense of time, unreal or absent self, emotional and/or physical numbing). [Depersonalisation]
B. Experiences of unreality or detachment with respect to surroundings (e.g., individuals or objects are experienced as unreal, dreamlike, foggy, lifeless, or visually distorted. [Derealization]

2. During the above experiences, does your reality testing remain intact?

3. Do your symptoms cause clinically significant distress or impairment in:
A. social life
B. occupational life
C. other important areas of functioning

4. Do you experience the above without the consumption of alcohol or any other substances?</td><td>1. YES / NO

2. YES / NO

3. YES / NO

4. YES / NO</td><td>CODE C1 Exclude</td></tr>
<tr><td>6</td><td>Have you ever been clinically diagnosed with:

a. Psychosis
b. Schizophrenia
c. PTSD</td><td>a. YES / NO
b. YES / NO
c. YES / NO</td><td>CODE D1 Exclude</td></tr>
<tr><td>7</td><td>Have you been previously clinically diagnosed with Depersonalisation-Derealisation Disorder?</td><td>YES

NO</td><td></td></tr>
</table>

8	*Have you ever had or do you currently have:* a. *Epilepsy?* b. *Any neurological condition?* c. *Head injury?*	a. YES / NO b. YES / NO c. YES / NO	CODE F1 Exclude
9	*Are you taking any regular prescription medication particularly psychiatric medication?*	YES NO	Say: *Please let us know if there are any changes to your medication across the duration of the study.*
10	*Do you have any physical impairment, disability or limitation that you feel may affect your ability to perform dance tasks?*	YES NO	CODE G1 Exclude
11	*Do you regularly take part in physical activity/exercise?* *If so, what kind of activity? (i.e. running, dance classes, zumba, weight lifting, pilates, etc.)* *How do you rate your level of engagement with athletics in general?* 0 = no engagement 1 = physical activity once/twice per month 2 = physical activity once per week 3 = physical activity 3x/week 4 = physical activity more than 3x/week	YES / NO	
12	*Do you regularly:* *a. Do yoga* *b. Mediate*	a. YES / NO b. YES / NO	

13	**a.** How often do you have a drink containing alcohol? 0 points - Never 1 point - Monthly or less 2 points - 2 to 4 times a MONTH 3 points - 2 to 3 times a WEEK 4 points - 4 or more times a week SCORE A: **b.** How many units containing alcohol do you have on a typical day when you are drinking? 0 points - 1 or 2 units 1 point - 3 or 4 units 2 points - 5 or 6 units 3 points - 7, 8 or 9 units 4 points - 10 or more units SCORE B: **c.** How often do you have six (female) eight (male) or more units on one occasion? 0 points - Never 1 point - Less than monthly 2 points - Monthly 3 points - Weekly 4 points - Daily or almost daily SCORE C: TOTAL SCORE (A+B+C):		Audit score >5 (females), >7 (males) is EXCLUDED A total of: 5 or more is a positive screen 0 to 4 indicates low risk 5 to 7 indicates increasing risk 8 to 10 indicates higher risk 11 to 12 indicates possible dependence **INCLUDED CODE M( ) (score)** **EXCLUDED CODE H( ) (score)**

14	*Aside from caffeine, nicotine or alcohol, do you currently use any recreational drugs more than three times per month?*	YES NO	 CODE I1 Exclude
15	*Are you currently undergoing any kind of psychological therapy (CBT, psychodynamic psychotherapy, etc.)?* *Have you previously undergone any kind of psychological therapy?*	YES NO YES NO	
16	*Are you right or left handed?*	RIGHT LEFT	

Control Screening Form

INTERVIEWER:

TELEPHONE SCREENING:
Bodily Awareness and Dance

DATE: TIME:

RESPONDENT INFORMATION

NAME:

GENDER:

CONTACT NUMBER:
EMAIL ADDRESS:

DOMINANT HAND:

AGE:

IF EXCLUDED: CODE _________________

DATE/TIME OF APPOINTMENT ____________________

INTERVIEWER:

AFTER INTERVIEW HAS FINISHED ENTER CODED DATA ON EXCEL SHEET WITH SCREENING ID

STORE THIS PAGE AND SHRED THE REMAINING PAGES

INTERVIEWER:

#	Question	Response	Action
1	*Can I confirm the spelling of your name?* *Thank you.*	NAME	
2	*How old are you?*	AGE:	<18 >70 CODE A1 Exclude
3	*Do you live in the city of London? If not, in which country do you live?*	WHERE:	

INTERVIEWER:

Screening ID:

INTRO:

Hello, is that______ ?

[If yes]

My name is ______ I am calling from Goldsmiths, University of London because you expressed an interest in a research study we are conducting, looking at bodily awareness and dance. We sent an information sheet about the study - did you have a chance to look at this? Are you still interested in taking part? [If yes] Is it ok to speak for five minutes now?

Thank you, I just need to ask you a few screening questions to see if you are eligible to participate in the study. We ask these questions to everyone who expresses interest. Try to be as honest as possible in answering these questions. I will let you know at the end of the questions whether or not you are eligible and if you are not eligible I will explain why. Okay? Great!

5	*DDD Diagnosis (DSM-5 criteria)* 1. Do you have the presence or persistent recurrence of: A. Experiences of unreality, detachment, or being an outside observer with respect to one's thoughts, feelings, sensations, body, or actions (e.g., perceptual alterations, distorted sense of time, unreal or absent self, emotional and/or physical numbing). [Depersonalisation] B. Experiences of unreality or detachment with respect to surroundings (e.g., individuals or objects are experienced as unreal, dreamlike, foggy, lifeless, or visually distorted. [Derealization]	1. YES / NO NO	CODE C1 Exclude
6	*Do you have any clinical psychiatric diagnoses?*	a. YES / NO	CODE D1 Exclude
7	*Have you ever had or do you currently have:* a. *Epilepsy?* b. *Any neurological condition?* c. *Head injury?* *Have you ever had neurosurgery?*	a. YES / NO b. YES / NO c. YES / NO YES / NO	CODE F1 Exclude
8	*Are you taking any regular prescription medication particularly psychiatric medication?*	YES NO	Say: *Please let us know if there are any changes to your medication across the*

9	*Do you have any physical impairment, disability or limitation that you feel may affect your ability to perform dance tasks?*	YES NO	CODE G1 Exclude
10	*Do you regularly take part in physical activity/exercise?* *If so, what kind of activity? (i.e. running, dance classes, zumba, weight lifting, pilates, etc.)* *How do you rate your level of engagement with athletics in general?* 0 = no engagement 1 = physical activity once/twice per month 2 = physical activity once per week 3 = physical activity 3x/week 4 = physical activity more than 3x/week	YES / NO	
11	*Do you regularly:* *a. Do yoga* *b. Mediate*	a. YES / NO b. YES / NO	

13	**a.** How often do you have a drink containing alcohol? 0 points - Never 1 point - Monthly or less 2 points - 2 to 4 times a MONTH 3 points - 2 to 3 times a WEEK 4 points - 4 or more times a week SCORE A: **b.** How many units containing alcohol do you have on a typical day when you are drinking? 0 points - 1 or 2 units 1 point - 3 or 4 units 2 points - 5 or 6 units 3 points - 7, 8 or 9 units 4 points - 10 or more units SCORE B: **c.** How often do you have six (female) eight (male) or more units on one occasion? 0 points - Never 1 point - Less than monthly 2 points - Monthly 3 points - Weekly 4 points - Daily or almost daily SCORE C: TOTAL SCORE (A+B+C):		Audit score >5 (females), >7 (males) is EXCLUDED A total of: 5 or more is a positive screen 0 to 4 indicates low risk 5 to 7 indicates increasing risk 8 to 10 indicates higher risk 11 to 12 indicates possible dependence **INCLUDED CODE M( ) (score)** **EXCLUDED CODE H( ) (score)**

14	*Aside from caffeine, nicotine or alcohol, do you currently use any recreational drugs more than three times per month?*	YES NO	 CODE I1 Exclude
15	*Are you currently undergoing any kind of psychological therapy (CBT, psychodynamic psychotherapy, etc.)?* *Have you previously undergone any kind of psychological therapy?*	YES NO YES NO	
16	*Are you right or left handed?*	RIGHT LEFT	

A3

Chapter 5 and 6 supplementary material

Dance Task Scripts

Body Awareness: WARM UP
Let us begin with a short warm up. Please find a private space where you are comfortable moving around. When you have established a comfortable standing position within the space, take a moment to arrive in the space. Feel your feet firmly planted in the floor, as if you are a tree and your feet are roots, grounding you in this time and space. Take a moment here to breathe and notice how your body feels at this moment. How is your body feeling in this time and space? (Pause) Notice the space around you. What are the colours, the textures…? (Pause) Now that you have arrived in this space, slowly bring both arms up, lifting them out by your sides and up until your fingertips are pointing towards the ceiling. Feel a stretch up and out through your arms. Hold this for a moment and then release, bringing the arms back down and allowing your head to fall forward. Use the weight of your head to roll down through your whole body. Take this nice and slowly, relax and feel the weight of the head and the upper body rolling you down. Allow your knees to be bent while you are doing this, not holding any tension in the legs. (Pause) Now that you've rolled all the way down, feel as if you are a ragdoll, floppy and relaxed, just hanging forward. Release any tension you may be feeling in the head and neck by allowing the head to move from side to side. You are as floppy and relaxed as a ragdoll. (Pause) With the knees bent, slowly roll up, one vertebrae at a time, through your torso, chest, neck and head, and return to a comfortable standing position, once again feeling your feet firmly planted in the ground. Take a moment here to notice how your body is feeling now. (Pause) We will repeat this motion beginning by bringing your arms up and out by your sides until your fingertips are pointing towards the ceiling. (Pause) And then roll down, again feeling the weight of your head and body to bring you all the way down. (Pause) With your knees bent, feel again as if you are a ragdoll, releasing any tension in your head and neck. (Pause) Slowly roll up as you did before, one vertebrae at a time, through your torso, chest, neck and head and return to a comfortable standing position. (Pause) You will now repeat this for a third time – bringing the arms up towards the ceiling (Pause) and then rolling all the way down through your body and hanging like a ragdoll. (Pause) With your body still hanging forward, begin to walk your hands out in front of you on the floor until your body becomes the shape of a mountain. (Pause) Feel your hands firmly planted in the ground, like the roots of a tree, just as your feet are (Pause) Take a moment to play around with where your weight is – you may walk the hands back towards the feet and then back out again in front of you; you may shift your weight from one foot to the other; you may shift your weight from one hand to the other. (Pause) Notice how the body is feeling in this mountain position, as you shift your weight. (Pause) Now walk your hands back in towards your feet, until your weight is off of them and you are hanging over once again like a ragdoll. With the knees bent, roll up through the body and return to standing. (Pause) From here, find a comfortable sitting position on the ground and then from this seated position, find a comfortable lying down position. Notice how your body feels with your back, head, legs, and arms all relaxed onto the ground. (Pause) Slowly bring the arms above the head and begin to rock your feet in a back and forth motion, as if you were in a rocking chair, and notice this movement through the entire body. (Pause 10s or so) Bring your arms back to your sides and slowly roll off the ground, bringing yourself back up to standing. (Pause) Feel, again, your feet planted firmly into the ground, as if they were the roots of a tree and notice how your body is feeling now, in this present moment. Take a moment to breathe into your body.

Body Awareness: TASK
Well done. Now we will move on to the task. Please find a space where you're comfortable sitting on the floor and we will begin. When you have found a comfortable seated position, take the ball in your hands. Squeeze it and roll it around between the palms of your hands and over the tops of your hands, noticing how this feels. (Pause) Then, using your right hand, begin to roll the ball over your left arm, bringing it upwards from the wrist all the way to the shoulder. Play around with this, rolling the ball backwards and forwards, in a circular motion… however you would like. (Pause) Once the ball has reached your left shoulder, roll it all the way back down to your wrist and then repeat this on the other arm – taking the ball in your left hand and rolling it upwards from your right wrist to your shoulder and then back down so that both of your hands are holding the ball. (Pause) Now, using your dominant hand, begin to roll the ball over the surface of your neck and head. This can be in circular motions, forwards and backwards motions… just play around with the ball and the ways it can travel on the surface of your body. (Pause) Begin to bring the ball away from the head and neck and down across your collar bones and chest. (Pause) Continue rolling the ball down the chest and onto your torso. Notice how this feels on the different areas of your body. (Pause) Continue to play around with the ball and roll it from your torso to your lower back. Notice how it feels on your spine. (Pause) Bring the ball back to the front of your body and roll it back and forth across your pelvis, from one hip bone to the other. When rolling the ball remember to play around and have fun with it, the ball can be rolling in circles, forwards and backwards, however you like. (Pause) Then begin to roll the ball down your right leg on the upper surface of the thigh, down to the knee, and all the way down to your shin and calf. (Pause, long enough for them to do this to one leg) Bring the ball back up and repeat this on your left leg. (Pause, long enough for them to do this to one leg) Bring the ball down to your feet and, one foot at a time, roll the ball over the top and bottom of your feet. See how it can squish in between the toes. (Pause) Repeat this for both feet. (Pause) Now feel free to play around with the ball however you'd like, rolling it over particular parts of the body, holding it in your hands… however you would like to use it. (Pause) Notice how your body is feeling in this interaction with the ball. (Pause) From your seated position, slowly descend into a comfortable position lying down until your head, back, legs and arms are flat on the ground. (Pause) Place the ball on the ground next to you. Keep in mind those feelings you have just experienced of the ball traveling along the surface of your body. We will now repeat the same sequence as before but without the physical ball. Bring your focus to your hands and imagine the ball there, how it felt as it was rolling around in between your hands and traveling along the tops of your hands and fingers. (Pause) Begin to imagine the ball rolling over your left arm, traveling upwards from your wrist all the way to the shoulder. Play around with this, imagining the ball rolling the ball backwards and forwards, in a circular motion… however you would like. (Pause) Once the ball has reached your left shoulder, roll it all the way back down to your wrist and then repeat this on the other arm (Pause) Now, begin to imagine the ball rolling over the surface of your neck and head. This can be in circular motions, forwards and backwards motions… just play around with this and the ways this imagined ball can travel on the surface of your body. (Pause) Begin to bring the ball away from the head and neck and down across your collar bones and chest. (Pause) Continue rolling the ball down the chest and onto your torso. Notice how this feels on the different areas of your body. (Pause) Really tune into the sensations of the body and how it is feeling with this motion across the surface of it. Continue to play around with the ball and roll it from your torso to your lower back. (Pause) Bring the ball back around to the front of your body and roll it back and forth across your pelvis, from one hip bone to the other. Remember to play around and have fun with this, imagining the ball rolling in circles, forwards and backwards, however you like. (Pause) Then begin to roll the ball down your right leg on the upper surface of the thigh, down to the knee, and all the way down to your shin and calf. (Pause, long enough for them to do this to one leg) Repeat this on your left leg. (Pause, long enough for them to do this to one leg) Imagine the ball rolling down to your feet and, one foot at a time, roll the ball over the top and bottom of your feet and imagine it in between your toes (Pause) Repeat this for both feet. (Pause) Notice how your body is feeling in this

interaction with the imaginary ball. (Pause) Really tune into the sensations of the body and how it is feeling with this motion throughout it. Well done. Now, begin to imagine the ball permeating the surface of the skin and moving within the substance of your body. How does this feel, this imaginary ball traveling around the substance of your body? Allow the ball to travel wherever it wants to. Really tune into the sensations occurring within the body as this imaginary ball travels through it. (Pause). Now you can start to play with the properties of the ball including its size, weight, and speed. Begin to imagine that the ball is very heavy – imagine that the ball has found its way to your right arm – how does it feel there and how is it now moving there with this new, heavy weight. (Pause) Bring the ball down to your left leg, still imagining it is very heavy. How is the ball moving within your leg with this heavy weight. (Pause) Now begin to feel the weight of the ball slowly decrease until it becomes very light and can float, like a balloon filled with helium. The size of the ball also expands until it becomes the size of a basketball. Imagine this light, helium-filled basketball within your abdomen. How does this feel? (Pause) Now imagine that the ball becomes smaller again and is the weight of the ball you were holding before, but it is traveling very quickly. Allow the ball to travel throughout your body at this new speed, rolling and spinning from one location to another. (Pause) Continue to play around with the properties of the ball – is it heavy or light, is it small or big, is it traveling quickly or slowly? Really tune into how these different properties of the ball make your body feel. (Pause) We will now transition into allowing the body to respond to these sensations. Your body is now free to react and respond to this moving ball within your body. The body can respond in whatever way you would like. (Pause) Play around with this. (Pause) If the ball is small and light within your hand, does it begin to raise the hand off the ground? (Pause) If the ball is big, and heavy within your abdomen, does it roll you from your back onto one side of your body? (Pause) Feel free to move however you would like in response to this ball traveling within the substance of your body. There is no right or wrong. Allow these sensations to guide the movements of the body. Does the movement of the ball bring you to sitting upright? What does this feel like when you're sitting up? (Pause) Does the movement of the ball bring you to standing and traveling in the space? What does this feel like when you are upright? (Pause) Play around with these movements and really tune into the bodily sensations you are experiencing. Remember that there is no right or wrong. Allow your body to react and move in whatever way you'd like. Keep continuing with this. (Pause) Is the ball light or heavy now? Is it moving slowly through your body and keeping you on the floor or is it moving quickly and propelling you through the space? What are these sensations like that are happening within the body? (Pause) Well done. Now, from wherever you are in the space, allow yourself to sink back into the floor and return to lying down, with your back, head, arms and legs all relaxed into the ground. Imagine that this ball has now been split into pieces and is dissipating throughout your body. Imagine that pieces of it travel down to your toes, out to your finger tips, and up to the very top of your head until they reach the farthest points of your body. These pieces then leave your body and flow out into the space around you. Take a moment to lie there and notice how your body is feeling now that this ball has dispersed and left. (Pause) Breathe into your body and relax into the floor. (Pause) Really tune into your bodily sensations and notice how these are different from or the same as before. (Pause for 20-30s) Well done. We have now come to the end of the task.

Dance Exercise: WARM UP

Let us begin with a short warm up. Please find a private space where you are comfortable moving around. When you have established a comfortable standing position within the space, take a moment to arrive in the space. (Pause) We will now go through a series of simple movements and stretches to get the body moving. Let us begin with some simple jogging on the spot. If you don't feel comfortable jogging, just bounce your knees slightly to the beat of the music. 5, 6, 7, 8 (Pause) Keep going! 3….2….1. Well done. Now we will do side stretch – take a wide stance with your feet, a bit beyond your hips, and reach over the top of your head with your right arm all the way until you're stretching out towards the left side of the room. Hold this (Pause) Excellent, now we will do the same motion with the left arm stretching over the head and towards the right side of the room. (Pause) Let us continue with some neck rolls side to side to help release any tension being held there. Bring your head towards your right shoulder, and then roll it forwards and out to the left – repeat this side to side. (Pause) Now we will do some balances. Put all of your weight onto your right leg and slowly bend and lift your left knee up towards the ceiling. Hold this for 8, 7, 6, 5, 4, 3, 2, 1. Excellent. Now we will repeat this transferring your weight to your left leg and then slowly bending and lifting your right knee up towards the ceiling. Hold this for 8, 7, 6, 5, 4, 3, 2, 1. Now imagine you are standing in a square. Step your right foot back, out towards the back right corner of the square and then step your left foot back out towards the back left corner of the square. Now step your right foot forward towards the middle of the front of the square, and do the same with your left. Repeat this motion of stepping out towards the back corners and back in towards the front middle of the square 8 times. 1, 2, 3, 4, 5, 6, 7, 8. Great! The last thing we will do is a simple grapevine. Begin stepping out to the right with your right leg, then cross the left leg back behind the right, then step out to the right again with your right leg and finish with a jump bringing both feet together. We will repeat this on the other side. Step out to the left with your left leg, cross the right leg back behind the left, step out to the left again with the left leg and finish with a jump bringing both feet together. Let's repeat this again to the right (count it out), left (count it out), right (count it out), and left (count it out). Well done! Let us finish now reaching both arms up towards the ceiling, and then rolling down using the weight of the head to roll you down towards your feet. Keep your knees bent and hang here for a moment with the feeling of being a floppy ragdoll. Then roll up through the spine, bringing the head up last. Take a moment to breathe into your body.

Dance Exercise: TASK

Well done. Now we will move on to the task. In this movement sequence, we will be using the same motions you just completed in the warmup, but with slightly different dynamics, so you're all set up to go through the sequence! We will begin with jogging on the spot, or knee bounces if this is more comfortable, for 8 counts. Ready, 5, 6, 7, 8. (Allow time for 8 counts of jogging). Great! The next step will be the side stretch, but this time adding some simple taps of the feet. Let's start with the legs first. Begin by stepping out to the right with your right foot, shifting your weight onto your right side so you can then tap your left foot on the floor. Then step out on to the left with your left foot, shifting your weight onto your left side so you can then tap your right foot on the floor. Repeat this motion a couple times from right to left. (Pause) Great. Now we will add the arms. When you step out towards the right onto your right foot, reach over the top of your head with your left arm until it's reaching towards the right side of the room. Then bring the left arm down and step out towards the left with your left foot and reach over the top of your head with your right arm until it's reaching towards the left side of the room. Great! Now let's do this 8 times to the rhythm of the music. 8, 7, 6, 5, 4, 3, 2, 1. The next step is the knee cross. Step out to the right with your right foot, and at the same time as you do this, bring your left knee up towards your chest. Then repeat this to the left – step out to the left with your left foot and at the same time bring your right knee up towards your chest. Repeat this a couple of times. (Pause) Now we will add the arms. When you bring your left knee up, bring your right hand down in the shape of a fist and tap your left knee. Then, on the other side, when you bring your right knee up, bring your left hand down in the shape of a fist and tap your right knee. Repeat this a couple of times. (Pause) Now let's do this 8 times to the rhythm of the music, starting stepping to the right. 8, 7, 6, 5, 4, 3, 2, 1. Great! The next step is the grapevine, which you already learned in the warmup. Start by stepping out to the right with your right foot, then step behind your right foot with your left, then step out again with the right foot and finally jump together bringing both feet in. Repeat this to the left by stepping out to the left with your left foot, then step behind your left foot with your right, then step out again with the left foot and finally jump together bringing both feet in. Well done! Let's do this 8 times to the rhythm of the music, starting with the right foot. 8, 7, 6, 5, 4, 3, 2, 1. The last step will be the star reaches. Your feet are doing the same as they did in the warmup when you imagined you were standing in a square. Step your right foot back, out towards the back right corner of the square and then step your left foot back out towards the back left corner of the square. Now step your right foot forward towards the middle of the front of the square and do the same with your left. Repeat this a couple of times (Pause). Now we will add simple arms. When you step back with your right foot, bring your right arm up and out to the side, coming off your body in a diagonal, and do the same with the left arm when you step back with the left foot. That brings your arms up in the shape of a V. Then when you step your right foot forward towards the middle of the front of the square, bring your right arm back down and then repeat this with the left arm when you step your left foot towards the middle of the front of the square. Try this a couple of times. Arm up-up, down-down; up-up, down-down. Well done! Now let's do this 8 times with the arms and legs to the rhythm of the music, stepping back with the right foot first. (count them in) 1, 2, 3, 4, 5, 6, 7, 8. Great! Now we will put the sequences altogether. Remember there are no rights and wrongs. Just try your best and keep moving to the rhythm of the music. We will begin with a sequence in counts of 8. 8 jogs, 8 side stretches, 8 knee crosses, 8 grapevines, and 8 star reaches. I will count you in. 5, 6, 7, 8. Jogs! 7, 6, 5, 4, 3, 2, 1. Side stretches! 7, 6, 5, 4, 3, 2, 1. Knee crosses! 7, 6, 5, 4, 3, 2, 1. Grapevines! 7, 6, 5, 4, 3, 2, 1. Star reaches! 7, 6, 5, to the left, 3, 2, 1. Excellent! Take a moment to breathe. (Pause) Now we will repeat this in a sequence of 4. 4 jogs, 4 side stretches, 4 knee crosses, 4 grapevines, and 4 star reaches. It is the exact same sequence, just a shorter amount of time for each step. I will count you in. 5, 6, 7, 8. Jogs! 3, 2, 1. Side stretches! 3, 2, 1. Knee crosses! 3, 2, 1. Grapevines! 3, 2, 1. Star reaches! 3, to the right, 1. Excellent! Take another moment to breathe. (Pause) Now we will repeat this one more time but in a sequence of 2, so this will be pretty fast! Don't worry if you make a mistake, as long as you keep moving to the rhythm of the music, that's all that matters. Just try your best. Ready, I will count you in. 5, 6, 7, 8. Jogs! 1. Side stretches! 1. Knee crosses! 1. Grapevines! 1. Star reaches (to the right)! To the left. Well done! Take a moment to breathe and have a drink of water. We have now come to the end of the task.

Table List

Figure List