Dance, Rhythm and Autism Spectrum Disorder: A Scoping Study

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Abstract

This topic of research moves the field of dance and movement therapy (DMT) into an area of clinical and social relevance by investigating the most beneficial features of rhythm and music for children diagnosed with Autism Spectrum Disorder (ASD). The current literature suggests that rhythm, used both inside and outside of DMT, can improve communication skills and social development in children with ASD. However, the optimum features of music and rhythm are ambiguous, consequently limiting the integration of rhythm-based interventions into practice. To answer the research question "*What are the most common features of music and rhythm used by registered dance and movement therapists for children with ASD?*", we surveyed 113 registered dance and movement therapists, regarding the most common features of music and rhythm they used within their sessions with autistic children. Most dance and movement therapists used music that had a 4/4 time signature (64%), was moderato tempo (45%) and had lyrics (76%). Qualitative findings validated why these were the most common features of music and rhythm. These musical elements could regularly be integrated into new music and rhythm-based interventions targeting communications skills and social development for children with autism in order to improve their therapeutic potential.

*Keywords***:** Autism Spectrum Disorders, Children, Dance and Movement Therapy, Rhythm, Communication Skills**,** Social Development**.**

1. Introduction

1.1 Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is one of the most common childhood forms of neurodevelopmental disability in the western world (Scharoun et al., 2014). In the UK alone, it is proposed there are over 700,000 individuals on the autistic spectrum, with 1 in every 100 children being diagnosed with the disorder (Brugha et al., 2011; National Autistic Society, 2019). ASDs are grounded in atypical communication and poor social development, concurrent with repetitive and patterned behaviours. These issues can cause disruption in activities of daily living, place considerable strains on families and often leave people feeling isolated and lonely. Alongside personal and familial implications, ASD can also carry huge financial burdens (Loynes, 2001). A detailed report, exclusively reviewing the cost of autism in the UK in 2001, estimated a figure of £1 billion for the total annual cost of autism (Järbrink & Knapp, 2001). However, a report later published in 2009 estimated the aggregate national costs each year of supporting children with ASD in the UK were closer to £2.7 billion and for adults were £25 billion (Knapp et al., 2009). Therefore, showing a substantial increase in the cost of autism in just 8 years. With more and more children being diagnosed with autism each year, there is a social and clinical need for new and innovative interventions to treat and reduce the unwanted symptomology associated with the disorder; not only to help with personal and familial implications, but to also minimise the disorder's financial impact on society and families.

Atypical communication and poor social development are two key symptoms observed in autism, and these can make integration into society very difficult for some individuals. Communication deficits in adulthood are associated with small social circles, limited positive social exchanges, less frequent participation in social activities and high levels of loneliness (Palmer et al., 2016). Therefore, it is vital to create interventions that support a child's development of communication skills and enhance their social competence prior to adulthood. There is a general agreement between professionals that early intervention is central to enable a child to reach their full potential, and in some cases early intervention may reduce the need for services later on in life (Jordan et al., 1998; Matson et al., 2011).

1.2 Dance and Movement Therapy

Dance and movement therapy (DMT) or dance and movement psychotherapy (DMP) is a promising intervention shown to increase communication skills and improve social development in individuals diagnosed with ASDs (Devereaux, 2012; Fitzpatrick, 2018; Koch et al., 2015; Lee & Vargo, 2017; Martin, 2014; Tortora, 2005). As defined by the American Dance Therapy Association (ADTA), DMT is the "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).

Before verbal language develops, infants and young children often communicate through their bodies, using gestures and movements. For that reason, DMT is well suited to working with children as it provides an integrative approach that incorporates the body and mind, thriving in the non-verbal realm of communication (Martin, 2014). DMT

focuses on body awareness, timing and rhythm, and motor co-ordination by utilising techniques; such as, mirroring, synchronous movement interaction, and rhythm. The nature of DMT sessions also encourages positive social development and enhances communication skills in children with ASD (Devereaux, 2012; Martin, 2014; Cozolino, 2014; Tortora, 2005; Field et al., 2001; Koch et al., 2015).

1.3 Rhythm

Rhythm is a naturally intrinsic part of our basic human physiology. We are neurologically built to create, process and respond to rhythms (Cruz, 2018). Multiple areas of the brain; for example, the motor cortex, somatosensory cortex, basal ganglia, and cerebellum are dedicated to receiving and processing different rhythms, and generating movement responses (Cruz, 2018; Thaut & Abiru, 2010). Evidence demonstrates that the auditory and motor systems are densely connected. The auditory system projects into the motor structures of the brain, creating entrainment between the rhythmic signal and the motor response (Thaut & Abiru, 2010).

As a result, the technique of rhythm is widely used throughout the DMT community. By creating internal rhythms within the body and using music to drive external rhythms by providing timing for movement, the element of rhythm proves fundamental to DMT. It allows therapists to attune to their client, help organise the client's feelings and facilitates interaction and communication (Martin, 2014). Additionally, the techniques used in DMT, such as mirroring and rhythm are effective elements that can be used outside the realm of DMT (under review; [redacted]). For example, the technique of rhythm has been extended to rhythmically-facilitated interventions; such as

dyadic drumming and melodic-based communication therapy (Sandiford, 2013; Willemin et al., 2018; Yoo & Kim, 2018). Such rhythm-based interventions have shown several positive effects enhancing communication skills and developing social interactions by increasing verbal attempts, level of co-operation and self-control, alongside improving scores on the Childhood Communication Checklist II (Srinivasan, et al., 2016; Stephens, 2008; Willemin et al., 2018; Yoo & Kim, 2018).

Despite the auspicious results of rhythm used both within and outside of DMT, there are very few successful interventions or activities used by clinical practitioners or within schools that exploit rhythm's potential therapeutic benefit. Perhaps the lack of clarity surrounding rhythm in music hinders its application? Furthermore, it's unclear if music and rhythm are essential for the positive benefits observed in DMT. Currently, the optimum time signature or tempo of music played during DMT sessions are unknown, and it is unclear if the music played is purely instrumental or has lyrics. All these elements could potentially impact the effectiveness of new rhythm-based interventions for autistic children (Srinivasan, et al., 2016). Furthermore, no study to date has investigated these elements (time signature, tempo or lyrics) within DMT sessions for children with ASD. As a result, before new rhythm-based interventions are introduced, the most beneficial elements of rhythm in music should be established. Once the optimum features of rhythm and music are known, these can be integrated into already existing or new interventions, enhancing their therapeutic potential. Then, interventions will a greater positive impact on autistic individuals, enabling them to integrate successfully into society and reducing the personal, familial and financial implications associated with ASD.

1.4 Research Question

In order to understand the key components of rhythm and music used during DMT sessions, we pose the research question: "What are the most common features of music and rhythm used by registered dance and movement therapists for children with ASD?". We hope that by establishing how often rhythm is used, and the most common types of music and rhythm used by experienced dance and movement therapists, this music style can be confidently integrated into new rhythm-based interventions targeting communication skills and social development, in children diagnosed with ASD. To our knowledge this is the first study that investigates the elements of music and rhythm used by dance and movement therapists during their sessions with the young ASD population. Therefore, we have taken an exploratory stance - instead of being driven by 'hypothesis testing', we are driven by 'hypothesis building'. Although we predict that some musical elements will be used more frequently than others by experienced dance and movement therapists, it is currently unclear what these may be, or why they are chosen.

2. Methods

2.1 Recruitment and Participants

Similar to the Delphi Model, which only interviews "experts" in the field, we implemented non-random purposive sampling, deliberately inviting registered dance and movement therapists, who have experience of working with children diagnosed with ASD, to participate in the survey (Steurer, 2011). To recruit the specific sample, details of

registered dance and movement therapists across the United Kingdom (UK) and United States of America (US) were collected via the Association for Dance Movement Psychotherapy UK (ADMP) and the American Dance Therapy Association (ADTA) online directories. Those who noted working with the ASD population were catalogued and later contacted. In total approximately 563 Dance and Movement Therapists were contacted via email (12 Men and 551 Women; unknown age; graduate level or above). In addition, the ADMP advertised the survey in the July issue of their newsletter.

Ethical approval for the study was given by the Science and Health Ethics sub-committee at the University of Essex (Ethics ID: ETH1920-1409). Prior to completing the survey, all respondents were required to give their informed consent to participating online by answering a Yes/No checkbox. A total of 155 participants were recorded accessing the survey; 113 of these consented and fully completed the survey, 2 respondents did not consent and 40 participants only provided a partial response. Accordingly, only the results of those who consented to and fully completed the survey were analysed (n=113). As a result, there were no missing responses from the data set analysed.

2.2 Materials

Participants completed the online survey, which was hosted on the Qualtrics™ platform (Qualtrics, Provo, UT). Online surveys allow for enhanced access to geographically dispersed participants, reduced costs, increased participant safety and anonymity, greater flexibility for scheduling, and question diversity (Drabble et al., 2016; Evans & Mathur, 2005). The survey was designed to capture relevant information regarding the use of rhythm by dance and movement therapists during their sessions and to

collect information regarding the time signatures and tempos of music used, and whether lyrics were included. In addition, we wanted to understand the therapists' reasons and justifications for using such rhythms, and the significance of their choices. Although most DMT sessions are unique to each child (patient/person-centred), we asked the dance and movement therapists to focus on the most common types of time signatures, tempos and lyrical/instrumental music they regularly used in every session.

The survey was structured in a sequential order, firstly requiring information on the dance and movement therapist before moving onto questions regarding rhythm and music. It consisted of five main sections, covering 26 items. The sections included the following: 1) the use of music, 2) the time signature of their music, 3) the tempo of their music, 4) the use of lyrics in their music, and 5) the use of rhythm. The survey items were tested for clarity, readability, and content by an independent researcher and changes were made to the wording of some items based on their feedback.

Measures were taken via a wide range of question/response styles in the survey; such as, multiple choice questions, sliding scales and open-ended text boxes. Logic breaks and skips were also included in the survey. For this reason, if a participant reported only using instrumental music in their sessions, they would not be asked the item question on what type of lyrics were usually included in their music. Consequently, the total number of respondents for each question differed.

Quantitative measures were taken via multiple choice questions or sliding scales. For example, some multiple choice questions involved asking participants to select what type of time signature they commonly used during their sessions for autistic children, out of 5 possible answers (A) *4/4 time*, B) *3/4 time*, C) *2/4 time*, D) *6/8 time*, or E) *Other)*, or

asking participants' if they found the rhythm of music important during their sessions via Yes or No choices. Similarly, participants were instructed to, for example, "Rate the extent to which [they] emphasised rhythm during [their] sessions.". Items such as this were rated on a 10-point scale from 0 *(I do not strongly emphasise the rhythm of music),* to 10 *(I strongly emphasise the rhythm of music)*, where 5 equalled "*I somewhat emphasise the rhythm of music"*.

Qualitative measures were used to establish why the dance and movement therapists commonly used the features of music and rhythm they had selected. The qualitative measures were then taken via text box answers, giving participants unlimited space to detail. Most followed the multiple choice or sliding scale responses, for example, asking why they generally used music with that time signature or why they emphasised rhythm to that extent.

2.3 Procedure

Data collection ran for 5-weeks from June 2020 to July 2020. A standard email invitation was sent out to every catalogued dance and movement therapist, outlining the project and providing a link to the online survey. A follow-up email was also sent a week prior to the survey closing, thanking those who had participated and reminding those who had not completed the survey that it would be closing soon. On average the survey took 22-minutes to complete, removing four outliers who appeared to take over 8-hours. Those who expanded on the open-ended questions took longer than respondents who only provided brief answers.

2.4 Analysis

Screening of data was carried out on the Qualtrics platform and using SPSS (IBM SPSS Statistics, 2017). Quantitative data (multiple choice answers and rating scales) were analysed using SPSS and GraphPad Prism 8 (GraphPad Software, 2020); where descriptive analysis was carried out, frequency tables produced and graphs created.

Analyses of the open textbox answers, which mostly consisted of brief statements, including; short sentences, phrases and paragraphs in response to the questions, were performed using the qualitative analysis software, NVivo12 (NVivo, 2018). As previously mentioned in the introduction, this study was not driven by confirming hypotheses, rather it was driven by building hypotheses. Therefore, we took an exploratory, "content-driven" stance when analysing the qualitative data (Braun & Clarke, 2013; Guest et al., 2012). Inductive thematic analysis was carried out as there were no previous studies investigating this research question, therefore the coded themes were derived directly from the text data and not from predetermined categories (Guest et al., 2012; Hsieh & Shannon, 2005). Briefly, inductive thematic analysis is a qualitative method that allows for the identification, analysis, and reporting of patterns or themes within data (McLemore et al., 2014). Where themes capture important elements about data in relation to the research question, and represent some level of response pattern or meaning within the data set (Braun & Clarke, 2006; Swart, 2019).

To this end, textbox answers were systematically read several times by an independent researcher to identify initial themes. As themes emerged, a coding framework was developed. Words, phrases and sentences were coded under different themes until saturation was perceived, meaning no new themes were uncovered and all relevant

meaning had been extracted from the data (*see below*; Glaser & Strauss, 2017; Guest et al., 2006; Strauss & Corbin, 1998). A team of researchers discussed the coding framework and outcomes of analyses, agreeing that saturation had been reached. Themes were then later divided in themes and subthemes, all which can be seen in Tables 2, 3 and 4 of the results section. Subsequent concept maps were created for each question in order to identify possible connections between different main themes and their subthemes, and to enrich understanding of the data (Braun & Clarke, 2006).

The following demonstrates how the described method above was carried out using a participant's response to the question "Why do you choose to emphasise the rhythm of the music to this extent?":

> *"Rhythm is fundamental to relationships. Each of us have different rhythms/vibrations. Being able to be comfortable with our own rhythm and other people's rhythm can support what Trevarthen coined "interactional synchrony.""*

This response was coded in the following way:

Rhythm is fundamental to relationships = Building relationships (subtheme) > Social Skill (main theme)

Each of us have different rhythms/vibrations = Emphasising body rhythms

Comfortable with our own rhythm and other people's rhythm = Emphasising body rhythms

Can support what Trevarthen coined "interactional synchrony" = Connection and synchrony (subtheme) > Unifying feature (main theme)

3. Results

3.1 Characteristics of Respondents and Sessions

Of the 113 usable responses, participants of the survey were all working dance and movement therapists, who were either registered with the ADMP or the ADTA. All respondents were English speaking or had English as their second language and were over the age of 18 years old. Most resided in the USA (72%). However, 19% lived in the UK, 3% lived in Canada, 2% lived in India, 2% lived in the Netherlands and 3% lived in Japan, Taiwan or Israel. We did not ask specifically for their age (all were over 18 years old) – only how long they'd been practicing for, or their gender as we did not believe gender would impact our results.

The sample was relatively experienced. The majority (51%) had over 10 years of experience and had worked with children diagnosed with ASD on a regular basis, or had previously worked with this population (Table 1). Survey results indicated that DMT sessions were predominantly focused on encouraging social interaction and enhancing communication in children with ASD and mostly lasted 45 minutes (Table 1) .

Table 1

Demographics of respondents referring to experience of working as dance and movement therapists, the frequency at which they work with children diagnosed with Autism Spectrum Disorders and the length of time of their sessions with this population in minutes (n=113).

Survey Questions		N (%)
	1 - 2 Years	6 (5.3)
	2 - 4 Years	13 (11.5)

How long have you been a dance and movement therapist/psychotherapist for?	4 - 6 Years	14 (12.4)
	6 - 8 Years	11 (9.7)
	8 - 10 Years	11 (9.7)
	10+ Years	58 (51.3)
How often do you work with children diagnosed with Autism Spectrum Disorders?	Once a week	17 (15.0)
	Twice a week	8 (7.1)
	Three times a week	9 (8.0)
	Four times a week	5 (4.4)
	Daily	5 (4.4)
	I am no longer working with this population; however, I previously have done	54 (47.8)
	Other	15 (13.3)
On average how long are your sessions with each child?	15 Minutes	2 (1.8)
	30 Minutes	38 (33.6)
	45 Minutes	49 (43.4)
	60 Minutes	21 (18.6)
	60+ Minutes	3 (2.7)
	Total	113

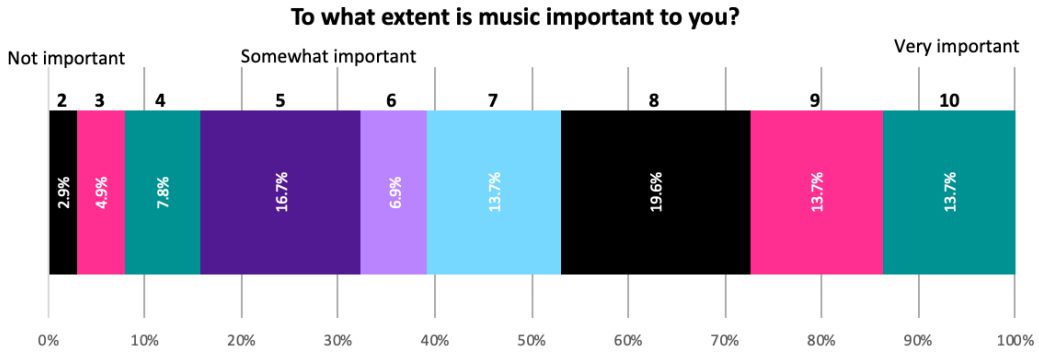
3.2 Use of Music

The majority (n=102; 90.3%) of respondents reported regularly using music within their sessions. Only 11 respondents (9.7%) answered 'No' to the question "Do you use music in your sessions?". Those who did not use music were taken to the end of the survey and were not asked anymore questions on music within their sessions, whereas those who did use music were asked what type of music they used. Pre-recorded music (n=92; 90.2%) was most commonly used over live music (n=10; 9.8%).

Additionally, nearly half of the respondents who used music found it very important (n=48; 47%). The difference in the extent to which music was considered important to the respondents is indicated by the Likert Scale in Figure 1.

Figure 1

The extent to which music is important to the respondents during their sessions with children diagnosed with Autism Spectrum Disorder as rated on a 10-point scale; where, 1-3 is not very important, 4-7 is somewhat important and 8-10 is very important (n=102). Points on the scale that had no responses were not included in the graph as they had a percentage of 0.



Respondents were asked why music was important to them and given a text box to type their answers. Thematic analysis of the data revealed five main overarching themes detailing why music was important. These included: 1) music setting an appropriate environment, 2) music helping to establish a connection, 3) music increasing engagement and attention, 4) music being used as a vehicle to explore rhythms, and 5) music helping with expression. Each main theme was comprised of various subthemes, which helped to further explain why music was important to the respondents. Table 2 presents the main themes and subthemes, and provides example quotes taken from the textbox responses that exemplify the given themes.

Table 2

Main and subthemes identified during thematic analysis of responses to the question "Why is music important to you?" (n=102). Exemplar quotes are also presented in the table for each theme and subtheme.

Main Themes	Subthemes	Quotes
Set the environment	Provides structure and organisation	"During sessions music to me is in the instrument of the body and the orchestra of the room/environment"
Establishing a connection	Establishing a connection	"Music can often be a really useful intervention to find 'common ground' between therapist and client with which to start the therapeutic rapport and trust building."
	Cohesion	"Particularly in group settings, music helps the children focus on the group tasks. It produces rhythmicity which allows the group to move together at the same time. It creates a feeling of one group."
Engagement and attention	Client chooses piece of music	"I primarily use music to support the clients "buying into" the session. They pick their own music from a digital library."
	Fun stimulus	"Most of all, the children I work with like it, and nothing works without an element of joy and play."
A vehicle to explore rhythms	A vehicle to explore rhythms	"Music is important in helping establish rhythm"
	Enhancing rhythmic movements	"It also provides rhythmic support, especially when working through movement development rhythms."
Expression		"Music can create a calming atmosphere, it gives the participant choice and the opportunity to express their likes and taste, especially if they are non-verbal.

3.3 Elements of Music

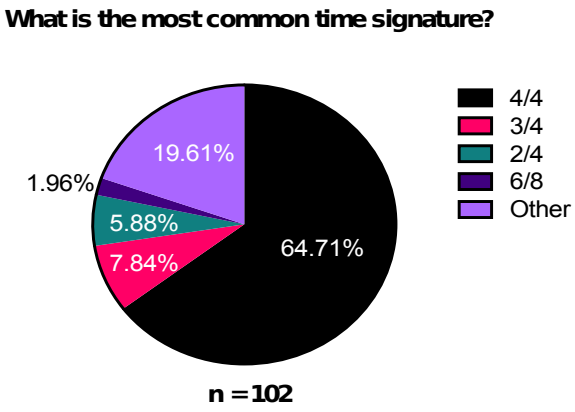
Specific elements of music were investigated during the survey, including the most common time signature of music used, the most common tempo of music used, and whether lyrics were commonly included in the music. It is apparent that there is a clear

type of music commonly used during sessions for children with ASD; this being, music of the 4/4 time signature, with a moderato tempo and including lyrics. Of the 102 dance and movement therapists that responded to the question "What, generally, is the most common time signature for the music you use?", nearly 65% answered 4/4 time, whereas only 7.8% commonly used 3/4 time (Figure 2a). Similarly, 45.1% of dance and movement therapists most commonly used music with a moderato tempo and just over 76% used music that included lyrics, in comparison to 24% of dance and movement therapists using instrumental music (Figure 2b and 2c, respectively). Interestingly, the choice of lyrics varied substantially between the respondents. Although nearly 40% of respondents reported using pop music lyrics, over half (n=40; 51.3%) reported using 'other'. Text box explorations revealed that most respondents chose 'other' because they used music with a variety of lyrics. For example, they may have used both nursery rhymes and pop music during their sessions and therefore selected 'other' as selecting more than one choice was not an option.

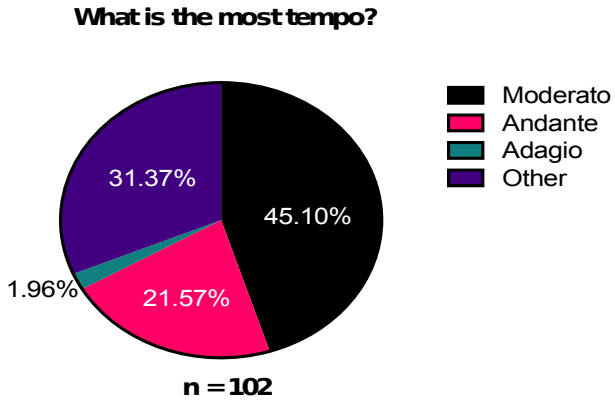
Figure 2

Parts-whole charts illustrating survey responses of (A) the most common time signature, (B) the most common tempo and (C) if lyrics were included in the music used by dance and movement therapists (n=102) during sessions for children diagnosed with Autism Spectrum Disorders. Not all choices are shown as answers that had no responses were not represented on the parts-whole charts as they had 0%. Keys shown at the side.

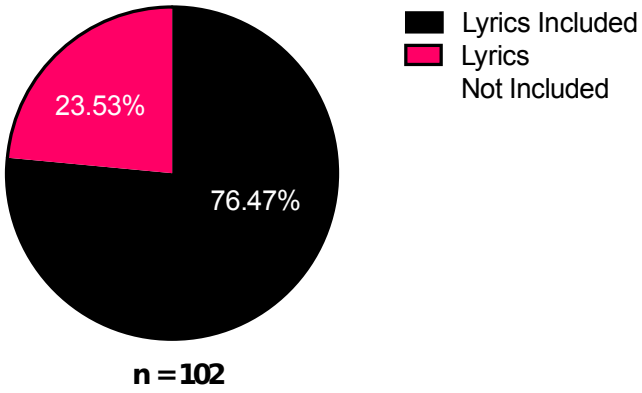
A


What is the most common time signature?
19.61%
1.96%
5.88%
7.84%
64.71%
4/4
3/4
2/4
6/8
Other
n = 102

B


What is the most tempo?
31.37%
45.10%
1.96%
21.57%
Moderato
Andante
Adagio
Other
n = 102

C



Qualitative analysis of survey responses uncovered several main themes and subthemes that validated why most dance and movement therapists used music with a 4/4 time signature and moderato tempo during their sessions for autistic children (Table 3). Examples of main themes include: 1) familiarity, 2) client preference, and 3) both elements were not overstimulating. Thematic analysis also revealed why pop music lyrics were often included in the music used for DMT sessions for children with autism; for example, pop music lyrics motivated the client and could often be used as positive reinforcement (Table 3). In addition, the majority of dance and movement therapists used a mixture of lyrics as they were able to better relate the lyrics to the client.

Table 3

Main themes and subthemes that emerged during thematic analysis of responses by those who answered 4/4 time to the question "Why do you generally use this time signature?" (n=66), by those who answered moderato tempo to the question "Why do you generally use this tempo?" (n=46), and by those who answered pop lyrics (n=31) and those who answered 'other' (n=40) to the question "Why do you generally use music with these lyrics?". Quotes that strongly represented each theme and subtheme are also given in the table.

Element of Music	Main Themes	Subthemes	Quotes
Time Signature (4/4)	Familiarity	Client Choice	"Music with the time signature seems to be relatable and familiar."
		Accessibility	"For me this is the most accessible signature."
	Grounding	Naturally occurring rhythms	"The body naturally falls into rhythms of 4... Repeat a phrase (in movement or song) 4 times helps to engage the body's natural rhythmicity"
	Regular Beat	Regular Beat	"It provides a strong, habitable rhythm that most people can physically match."
		Simple	"It is the simplest rhythm to follow
	Not overstimulating		"The simplicity also means that there is one less stressful thing for children who are still settling into the therapeutic process (more complicated rhythms might make it an overwhelming experience at the start)."
	Use in combination with other timings		"I also use 3/4 and 6/8 often for more "swaying" and regulating feelings."
Tempo (moderato)	Children prefer it	Children respond well	"I work with children and they respond to this speed well!"

		Fun	"I do like to use a moderato speed with a fun beat as a way of using rhythm to connect."
		Engages the client	"Usually using an excited pace to encourage activity within the group."
	Easy to vary from this tempo		"Within this speed, we have more options to play with time, speeding up or slowing down when clinically appropriate."
	Not overstimulating	Not overstimulating	"Helps clients engage but stay regulated/not over-stimulated"
		Not too fast or too slow	"The music wakes up the brain, not slow not fast just above a walking pace which seems to create an attentive state without creating a hyperactive feeling"
	Encourages movement		"It seems to be a good tempo for rhythmic movement for them"
Lyrics (Pop Music Lyrics)	Client choice/ Preference	Client Choice	"As it is the music that is requested most often by the children that I work with. By increasing their choice, I hope to support the development of their agency within the therapeutic process."
		Familiarity	"Children know these songs."
	Motivation	Motivation	"Kids know and like this helps get their excitement and buy in[to the session]."
		Positive Reinforcement	"This is typically what the children have requested to hear as a reward for hard work"
	Connection		"Usually can help participants feel connection to the social world around them!"
	Attending to the		"For me sometimes the lyrics are important to share an up-lifting message and promote

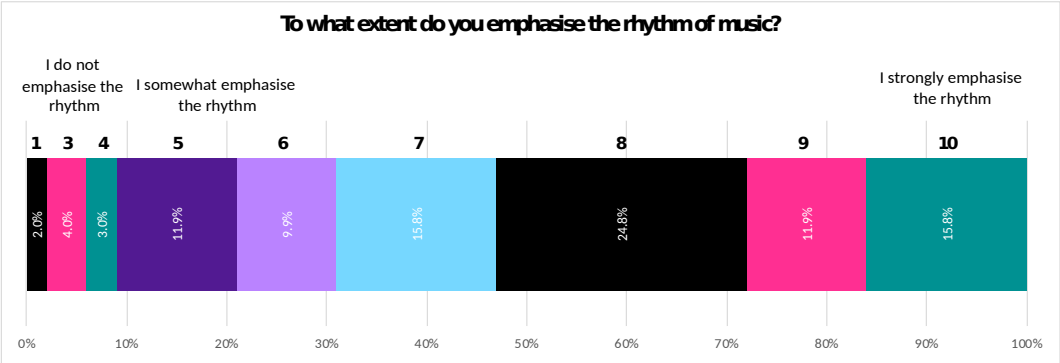
	lyrics		communication."
Lyrics (Other/Mixture)	Relatable to client	Relatable to client	"I usually selected it because the client liked the song, the artist or the genre."
		Familiarity	"Familiar songs help people engage with one another and provides them with a shared experience. It is an opening point for increasing communication and socialization."
		Client Expression	"Pop music is an option and choice that the participant has as a way of expression"
	Use of age dependent lyrics		"For the younger children, nursery rhymes are correlated to language. Familiar, repetitive words are helpful... For older students, they sometimes request things that are popular in the culture and it provides them with some structure and familiarity."
	Attending to a variety of lyrics		"I use educational lyrics to teach concepts or guide a group into moving in a more synchronized way."
	Building trust and communication		"Nursery rhymes are often learnt, very rhythmic and can be sung together with actions, this can create a link to bound to help build a relationship or create a structure."

3.4 Rhythm

It is evident that rhythm is extremely important to most dance and movement therapists and is believed to be essential for DMT sessions. Almost all respondents reported finding rhythm important (n=100; 98.04%) and less than 2% (n=2) stated they did not find rhythm important. Additionally, when asked the extent to which the dance and movement therapists emphasised the rhythm of music during their sessions over half of the respondents answered 'strongly emphasised' (n=54; 52.5%; Figure 3).

Figure 3

The extent to which respondents emphasised the rhythm of music during their sessions with children diagnosed with Autism Spectrum Disorder as rated by a 10-point scale; where, 1-3 is I do not emphasise the rhythm of music, 4-7 is I somewhat emphasise the rhythm of music and 8-10 is I strongly emphasise the rhythm of music (n = 102). Points on the scale that had no responses were not included in the graph as they had a percentage of 0.



We were also interested to know why dance and movement therapists emphasised the rhythm of music. Thematic analysis of responses given by those who found rhythm important (n=100) revealed several main themes, including: 1) rhythm used a unifying feature, 2) rhythm offered structure and organisation to the session, 3) it was grounding, rhythm offered structure to movement, 4) helped to emphasise body rhythms, and 5)

helped to build social skills. Furthermore, each main overarching theme also comprised of subthemes that further highlighted why rhythm was an important element of music and DMT sessions for children with ASD (Table 4).

Table 4

Main themes and subthemes revealed during thematic analysis of responses to the question "Why do you emphasise rhythm?" given by those who found rhythm important (n=100). Quotes that embody each theme and subtheme are also given in the table.

Main Themes	Subthemes	Examples/Quote
Unifying feature	Unifying feature	"The ability to share rhythm unites humankind and it is through rhythm that we engage with others (for example, turn-taking) and with our environment.
	Connection and synchronicity	"Each of us have different rhythms/vibrations. Being able to be comfortable with our own rhythm and other people's rhythm can support what Trevarthen coined "interactional synchrony."
Structure and organisation to the session		"Rhythm decreases tension, increases relaxation by providing predictability, structure and movement (a language that is universal)."
Grounding		"When exploring movement with clients, it is helpful to ground them so they didn't become overwhelmed. Stressing the rhythm helped them stay grounded in the present."
Structure to the movement		"It helps with the flow of movement and prevents the client from getting stuck (the rhythm helps them respond)."
Emphasising body rhythms		"Rhythm supports the human experience of presence especially when it is understood as a combination of exploring weight and time in movement. It supports the natural regulating aspects of biorhythms including the heartbeat and breathing patterns to allow for the development of emotional regulation practices that are transferrable outside of session."
Building social skills	Promotes self-awareness	"It is a brilliant tool for regulation and self-awareness without being too intrusive. It allows individuals to become aware of the timing of their behaviours which can be really useful in moments of difficulty."
	Building relationships	"Rhythm is fundamental to relationships."

4. Discussion

The aim of the study was to determine the most common features of music and rhythm used by registered dance and movement therapists for children with ASD and to understand why these were most commonly used. Overall, the results of this study highlight the importance of music and rhythm during DMT for children diagnosed with ASD and illuminate the reasons why they are important. Our findings also indicate the most common elements of music, including the 4/4 time signature, moderato tempo and music that has lyrics. Each common element was validated by the qualitative findings, with key themes and subthemes emerging from thematic analysis of survey responses. The data represented here advances our knowledge of the most common elements of music and the reasons behind their use, whilst also allowing us to generate more informed hypotheses regarding the potential impact of particular musical features for children with ASD. It is expected that these elements can now be used with greater confidence in new or existing interventions for children with ASD, targeting communication skills and social development.

4.1 Elements of Music

4.1.1 Time signature.

The data suggests 4/4 timing is the most common time signature used by experienced dance and movement therapists during DMT sessions for children with ASD. Several themes emerged during thematic analysis highlighting why it may be the most common time signature (Table 3). For example, a key theme that emerged was the ‘regular

beat' of the 4/4 time signature. One dance movement therapist explained that the timing "*provides a strong, habitable rhythm that most people can physically match*". Research indicates that a regular accent structure is essential for recognising a beat in music (Bouwer et al., 2018). When regular perceptual accents are presented, reproduction performance (i.e. physically matching the beat) is improved (Grahn & Brett, 2007). Furthermore, functional Magnetic Resonance Imaging (fMRI) has demonstrated that the basal ganglia, pre-Supplementary Motor Area/Supplementary Motor Area (SMA), and anterior superior temporal gyri show increased activity to specific beat-based rhythms (Grahn & Brett, 2007). Therefore, in addition to their role in movement production, which is important during DMT, the basal ganglia and SMAs may mediate beat perception, and children with autism may respond better to 4/4 timing as it provides a regular accent structure and beat-based rhythm.

Similarly, it is well established that many children diagnosed with ASD prefer structured routines, rituals and patterns. The repetitive and predictable nature of musical sounds, especially with this timing, may fulfil these preferences. Through the appreciation of musical sound patterns each child may feel more engaged and comforted by the regular and repetitive pattern of music with 4/4 timing, compared to any other musical timings (Molnar-Szakacs et al., 2009). Perhaps, most importantly, the regular and repetitive pattern of music with 4/4 timing minimises the likelihood of autistic children becoming overstimulated during DMT sessions. Preventing overstimulation was another key theme found for not only the use of music with 4/4 time signature, but also for moderato tempo and lyrics. As, autistic children can become overstimulated by new environments, bright lights, various noises or new people, it is important to use music and rhythms that limit the likelihood of autistic children feeling overwhelmed during DMT.

4.1.2 Tempo.

Several themes and subthemes emerged during thematic analysis detailing why moderato tempo was most commonly used in music during DMT sessions (Table 3). Many dance and movement therapists suggested that children preferred this tempo of music and also responded to it well. Research suggests that young children often prefer faster tempos to slower ones (Flowers, 1988; Montgomery, 1996). Additionally, slower tempos are associated with sadness or reflection, whereas faster tempos are associated with activity and happiness (Levitin et al., 2018; Poon & Schutz, 2015). Typically developing 5-year-olds are able to make these associations, and children with ASD may, too, be able to make them (Swaminathan & Schellenberg, 2015). Therefore, it is plausible that autistic children prefer and respond well to moderato tempo as they associate it with activity and happiness, in comparison to other tempos.

Themes around moderato tempo also indicated that it was most commonly used as it was not overstimulating for most clients, in that it was not too fast nor too slow. One dance and movement therapist noted "*Slower music I found lost my clients and they were unable to connect to the music, whereas faster music was overwhelming*." For children with autism finding the balance is very important. You need a tempo that engages and captivates them, but does not overstimulate and overwhelm them. It seems that most dance and movement therapists found that the moderato tempo was able to achieve this.

The theme encourages movement also emerged when qualitatively analysing responses to why moderato tempo was most commonly used. Many dance and movement therapists reflected on moderato tempo being a good tempo for rhythmic movement or

providing "*opportunities for children to work on building their movement repertoire*". This is known as entrainment of movement to music tempo (where we feel the desire to move to the beat/tempo of the music) and is only observed in vocal mimicking species (Schachner et al., 2009). Nietzsche, a famous musical philosopher, was believed to have said "*We listen to music with our muscles*" (Sacks, 2006). Therefore, it might be plausible that moderato tempo is the optimal tempo for entrainment in children diagnosed with ASD.

4.1.3 Lyrics.

The single most common style of lyrics used by dance and movement therapists was pop music lyrics, however it was apparent that the majority of dance and movement therapists used a mixture of lyrics; including, pop music, educational lyrics and nursery rhymes. Data from thematic analysis indicated that pop music lyrics were most commonly used as it was the client's choice and could be used as a motivator via positive reinforcement.

Autistic children may prefer music with pop lyrics as it is the most familiar style of lyrics. Studies have shown that liking a piece of music is related to familiarity with it or its style (Hargreaves, 2016; Madison & Schiölde, 2017). This familiarity factor can account for why children often accept a wide variety of musical genres when they are younger, before becoming increasingly fond of pop music as they grow older. Children begin to favour this musical style due to its familiarity and recognisability as it is regularly used in the commercial media (Woody, 2004). As children tend to prefer music with pop lyrics some dance and movement therapists used it to motivate their clients through positive

reinforcement. One dance and movement therapist stated "*This is typically what the children have requested to hear as a reward for hard work*". Many children diagnosed with ASD seem to ignore social reinforcers such as praise or affection; therefore, Toigo (1992) proposed that music, as it seemed to be so inherently pleasurable to children with autism, could be an important motivator or reinforcer.

The majority of dance and movement therapists, however, generally used a mixture of lyrics during their sessions. Themes emerged; such as, relatable to client, use of age dependent lyrics and attending to a variety of lyrics, during the qualitative analysis. The theme relatable to the client highlights the person-centred approach of DMT. Children prefer and respond differently to different musical lyrics. Therefore, using lyrics that are relatable to each client may produce further beneficial effects. Similarly, by using a variety of lyrics the dance and movement therapist can help the client attend to a variety of lyrics increasing their knowledge of vocabulary and understanding of different concepts. Studies show that children with ASD engage well with words and instructions sung to music (i.e. lyrics) in comparison to spoken words, and lyrics can increase engagement in language learning tasks (Dieringer et al., 2017; Simpson et al., 2013). Consequently, the use of lyrics during DMT and new or already existing psychotherapies may aid in the progress of communication skills and social development.

4.2 Rhythm

Over 98% of registered dance and movement therapists surveyed in this study reported finding rhythm important. Moreover, 52% of survey respondents said they strongly emphasised the rhythm of music during their DMT sessions. It is clear that the

rhythm of music is believed to be essential for many dance and movement therapists during their sessions with children diagnosed with autism. When asked why rhythm was important to emphasise, thematic analysis revealed several key themes; including, rhythm being a unifying feature, offering structure and organisation to not only to the session but also to movement, helping to build social skills and helping to emphasise bodily rhythms.

Due to the nature of music and rhythm, children with ASD may feel less isolated in group DMT sessions. With rhythm acting as "*a non-verbal unifier*" the music can serve as a nonthreatening environment in which children with autism and their peers can initiate and maintain communication (Darrow & Armstrong, 1999). The ability to share, attend and move to the same rhythm of music can help to unite individuals, increasing synchronicity and creating a connection. One dance and movement therapist explained "*Having a clear external stimulus [rhythm] can help with group cohesion and to emphasize being in synch with their peers*". Research has shown that adults who synchronously moved together to a shared musical rhythm were more likely to display prosocial behaviours towards each other than when moving asynchronously (Hove & Risen, 2009; Valdesolo & Desteno, 2011). Furthermore, infants who were bounced to music in synchrony with an experimenter were more likely to show altruistic behaviour towards the experimenter, than if they were bounced out of synch with the experimenter (Cirelli et al., 2014). Subsequently, interpersonal motor synchrony to music engagement may increase social bonds between group members, and moving to the same rhythm creates a potential vehicle to increase the development of prosocial behaviours in autistic children.

Qualitative analysis revealed rhythm provided structure and organisation to the session, whilst also offering structure to the movement. As previously established, children with diagnosed ASD have a need for structure, organisation and routine. Music and rhythm offer several layers of form and structure that provide a container for the session, with the rhythm creating a consistent through-line, keeping the session moving forward and the client aware. The often repetitive and predictable nature of rhythm and music makes an intrinsically structured stimulus for children diagnosed with autism (Darrow & Armstrong, 1999; Nelson et al., 1984). Rhythm also offered structure to the movement by helping with the flow of actions and preventing the child from becoming "*stuck*". Research demonstrates that coordinated movement to the rhythm of music arises with no specific training at a very young age. For example, in the first 2 years of life infants can move their bodies rhythmically in response to music (Zentner & Eerola, 2010).

Not only is rhythm an external stimulus, but it is also an internal stimulus. Many dance and movement therapists documented exploring bodily rhythms when emphasising the rhythm of music, with one noting "*It is really important to emphasise or stay curious with rhythms, as they are every part of us*". Interest around the role of biological and behavioural rhythms during typical and atypical development has been fast growing. Recent evidence from cognitive and developmental psychology studies emphasise the significance of rhythmicity and synchrony of motor, emotional, and interpersonal rhythms during the early development of social communication (Tordjman et al., 2015). Autism illustrates the possible consequences of physiological and behavioural rhythm disturbances on the development of social communication and repetitive behaviours or interests (Barnard & Nolan, 2008; Tordjman et al., 2015). Preliminary research suggests that behavioural disturbances observed in ASD may result from the inability of an individual's

circadian oscillator to entrain to environmental and social cues (Barnard & Nolan, 2008). Ultimately, the internal 'clock' cannot reliably or consistently co-ordinate internal rhythms with the external environmental and social rhythms of typical activity, leading to the profound consequences observed in ASD (Amos, 2013). Therefore, attending to the rhythm and timing of music during DMT or any other psychotherapeutic intervention, whilst focusing on the body's own rhythms may offer substantial therapeutic benefits for children with ASD.

4.3 Limitations

Overall the response rate of the survey was approximately 27.5%, which is deemed relatively low for survey response rates. It is suggested that researchers should aim for near to 60% response rate in order to reduce the nonresponse bias (Fincham, 2008; Sheehan, 2001). However, given that our sample size was relatively small (563 possible participants), and after assessing previously published literature, receiving over 100 responses was our initial aim (Schwartzberg & Silverman, 2014). Nevertheless, it cannot be ignored that more responses would improve the accuracy and reliability of our findings, whilst limiting the nonresponse bias.

In addition, the survey was highly focused on rhythm and music. However, the results indicated that nearly 10% of dance and movement therapists did not use music during their sessions. These participants were taken to the end of survey and asked the final question - "Besides music, what are the most important elements of your session for children diagnosed with ASD?". Upon reflection, it may have been beneficial to ask further questions as to why they did not to use music during their sessions and whether

they successfully incorporated the element of rhythm without the use of music, especially for children who are overstimulated by any type of music. These questions may have shed light on elements of rhythm that were not explored during this study.

Although online surveys have several benefits, they are not without their limitations. In comparison to interviews, the depth of qualitative findings obtained from online surveys is somewhat limited. Interviews allow researchers to ask further questions or ask respondents to elaborate on their answers, providing opportunities to probe and clarify any misunderstandings. Therefore, interviews may provide more detailed and in depth qualitative findings. However, given that this study was exploratory, the text box answers implemented in the survey were useful and sufficient in gaining an initial understanding as to why 4/4 timing and moderato tempo were the most common elements of music used during DMT session for children with ASD.

The aim of the study was not to create a 'one-size fits all' approach, rather to identify where may be an optimal starting point for dance and movement therapists to begin their practice or researchers to integrate rhythm into new interventions. The results clearly indicate that there are elements of music used by registered dance and movement therapists for children with autism more commonly than others, implying these may be the optimal elements to use. However, it must be highlighted that there is significant heterogeneity within ASDs, therefore one size cannot fit all. Whilst 4/4 timing with moderato tempo music may work well for one child, it may overstimulate another child or they may respond better to 3/4 timing waltz music. DMT prides itself on offering client-based, person-centred therapy; meaning, each session differs from one autistic child to the next.

4.4 Future Directions

During this investigation we took an exploratory and descriptive, hypothesis-building stance, exploring the various elements of music that may have been common during DMT sessions for children diagnosed with ASD. Despite the study's limitations, it is clear that the 4/4 time signature and moderato tempo are most commonly found in music used by registered dance and movement therapists for this clinical population. Equally, the music used most often had lyrics, although, it is somewhat unclear if there is a single 'type' of lyric included in the music. Moving away from the hypothesis-building stance, it now seems plausible to test possible hypotheses; for example, 'Children with ASD will respond better to pop music, with a 4/4 time signature and moderato tempo compared to X, Y, Z'. Behavioural observation studies could be implemented to record how children respond to pop music, with 4/4 time signature and moderato tempo compared with any another type of music. Observations may include frequency and duration of repetitive/stereotyped behaviours, facial expressions, frequency and duration of challenging behaviours and/or spontaneous movements to the music such as foot tapping or dancing (Bernardi et al., 2017; Juslin & Västfjäll, 2008).

Moreover, further quantitative studies could be performed to confirm the findings of this study. Moving towards a more empirical and neurobiological study-type, you could investigate the emotional and reward responses of children with ASD to pop music, with 4/4 time signature and moderato tempo. For example, you could record heart rate and skin conductance as autonomic measures of emotion and as an indicator of arousal when listening to this type of music (Rickard, 2012; Sloboda, 2010). Alternatively,

neuroimaging techniques could be utilised to explore brain connectivity. Many studies have indicated specific brain regions are associated with emotional and reward responses to music. Employing Positron-Emission Tomography, Blood and Zatorre (2001) showed that pleasant musical stimuli activated the dorsal amygdala, which connects to the ventral striatum and orbitofrontal cortex (the 'positive emotion' network), whilst simultaneously decreasing activity in central regions of the amygdala that appeared to be associated with unpleasant stimuli. Additionally, frontal lateralisation of activity in the cortex is associated with positive affect and pleasant responses to musical stimuli (Arjmand et al., 2017). As a result, one might hypothesise that similar responses will be observed in children with ASD when listening to pop music, with 4/4 time signature and moderato tempo in comparison to other pieces of music. However, children with ASD may find neuroimaging tasks invasive and uncomfortable. Therefore, extra precautions should be taken if this type of research is pursued.

4.5 Implications for practice and future practice

By establishing the most common features of music and rhythm, these elements can now be used with greater confidence in new or existing rhythm-based interventions, in order to improve their positive therapeutic outcomes; such as, increasing communication skills and social development. Furthermore, it is apparent that rhythm and music are somewhat inseparable and emphasising rhythm is extremely beneficial for children with ASD because it offers substantial therapeutic benefits for children with ASD. As previously alluded to, literature has demonstrated rhythm-based interventions significantly improve communication skills and social development in children with ASD (Daniel,

2019; Eren, 2015; Srinivasan, et al., 2016; Yoo & Kim, 2018). Therefore, it would be interesting to investigate if these effects are further enhanced by implementing the findings of this study. For example, Srinivasan et al. (2016) noted a limitation of their study was not tightly controlling or manipulating the individual effects of musical elements (pitch, melody, rhythm, tempo, etc.) on social attention skills. Therefore, replicating the study and including musical elements such as moderato tempo may increase the positive outcomes previously observed. In addition, future studies may wish to incorporate rhythm into physical interventions, due its beneficial effects in DMT. For example, sports-based interventions for children with ASD may include rhythmic music in the background or rhythmic music to attend to whilst completing the physical activity (Imankhah et al., 2018). From this, improved interventions could readily be implemented into practice at a relatively low cost or used in Special Education Schools during Physical Education (PE) classes.

A UK survey conducted in 2016 by the research charity Autistica asked autistic people and their families to list their top priorities for research funding (Autistica, 2016). Out of the top 10 selected areas, the top two were: 1) ‘How should mental health interventions be adapted for the needs of people with autism?’ and 2) ‘Which interventions are effective in the development of communication/language skills in autism?’. Our study may be helpful in answering these questions; for example, rhythm-based interventions or music and movement based interventions could be adapted to only include music with 4/4 timing and moderato tempo, as this type of music appears to be best received by children with autism in this particular study. Additionally, dance and movement therapists stated the main aims of their sessions were to encourage social interaction, improve social development and enhance communication. Therefore, these elements of music could be

the building blocks for new, successful interventions that are implemented into practice for the development of communication/language skills, as they have already shown positive outcomes in DMT.

5. Conclusion

In conclusion, the results from this study suggest there are common elements of music and rhythm used by registered dance and movement therapist during sessions for children diagnosed with ASD. These include: 4/4 timing, moderato tempo and the use of lyrics. These elements of music can now be more readily integrated into new interventions targeting communications skills and social development for autistic children. Furthermore, the data from this study indicates the importance of rhythm in music and emphasising rhythm for children diagnosed with ASD. As a result, psychotherapists may wish to integrate music and movement into their practice, whilst strongly emphasising the rhythm of music. However, as ASD is an incredibly heterogenous disorder, it is not conclusive that all children with autism will respond well to the common elements of music identified in this study.

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8. Tables and Legends

9. Figures and Legends