Change Process Research in Music Therapy: Introducing a Transdisciplinary Framework

音乐治疗中的变化进程研究：介绍一个跨学科框架

Lorenzo Antichi[1], Rebecca Zarate[2], Marco Giannini[1]
[1]Health Science Department, University of Florence, Italy
[2]The University of Utah, USA

Abstract

Music therapy is conceptualized as a systematic process of interventions and shared experiences that promote change in individualized health and wellbeing contexts. Change processes are crucial in music therapy, but little is known about certain factors, mediators, and mechanisms that cause or lead toward such change processes. There is a strong need for developments of theoretical and methodological frameworks of change in music therapy to achieve this goal. The current body of knowledge shows a lack of research on this topic, particularly on how to strategize and study change, how to understand research design and statistical analysis of change, and how to support and strengthen what is known today about change processes in music therapy. This article is grounded in theories that address complex interventions that cause a change in music and creative arts therapies as a means of guiding a dialogue about the potential for influencing research strategies and methods that investigate change processes. The review of the literature shows that although new studies about the efficacy of music therapy have been made in recent years, literature is extremely limited about predictors, moderators, shapes of change, stages of changes, processes, and mechanisms of change. There is strong evidence that music therapy works. However, it is not entirely known how, when, and why music therapy produces a change. Based on the findings in the current body of knowledge, further studies are needed to investigate every aspect of change with a pluralistic and interdisciplinary approach, which integrates methods from across the natural sciences, mathematics, arts, behavioral, and social sciences. This article introduces a framework addressing these issues, attempts to bridge current gaps in knowledge, expand capacity in the field of music therapy research, and equip clinicians, researchers, and professionals with tools and knowledge on change process research.

Keywords: change in music therapy, moderators, shape of change, process of change, mechanism of change, theoretical framework

摘要

音乐治疗被概念化为一种系统的干预和共享体验的过程，旨在促进个体健康和福祉的变化。变化过程在音乐治疗中至关重要，但目前对导致或引导这些变化过程的某些因素、调节因素和机制知之甚少。为了实现这一目标，迫切需要在音乐治疗中发展理论和方法框架。目前的知识体系显示，在如何战略性地研究变化、如何理解变化的研究设计和统计分析以及如何支持和加强当前对音乐治疗变化过程的认识方面，研究非常匮乏。本文基于涉及引起音乐和创造性艺术治疗变化的复杂干预理论，旨在指导关于影响研究策略

和方法的对话，研究这些变化过程。文献回顾显示，尽管近年来有关于音乐治疗效果的新研究，但关于变化的预测因素、调节因素、变化的形态、变化的阶段、过程和机制的文献极为有限。有强有力的证据表明音乐治疗是有效的。然而，目前尚不完全清楚音乐治疗如何、何时以及为什么会产生变化。基于当前知识体系中的发现，需要进一步的研究，以多元和跨学科的方法来调查变化的各个方面，整合自然科学、数学、艺术、行为和社会科学的方法。本文介绍了一个框架，解决这些问题，试图弥合当前知识的空白，扩大音乐治疗研究领域的能力，并为临床医生、研究人员和专业人员提供关于变化过程研究的工具和知识。

关键词: 音乐治疗中的变化, 调节因素, 变化的形态, 变化的过程, 变化的机制, 理论框架

Introduction

There is a complexity in entering a dialogue on change in music therapy because of various ways of understanding the nature of music therapy. On the one hand, there has been a discourse rooted and closely connected to positivistic, and post-positivistic, sometimes considered, reductionistic approaches that observe outcomes and behavioral change. On the other hand, there has also been an opposing discourse in the literature on the holistic, reflexive, co-constructive theory, and practice of music therapy. Across countries and cultures, the development of music therapy has involved one or both of these directions. The issues with these important components of theory and practice have also limited the dialogues and explorations of research in music therapy. This has created a somewhat fragmented approach to outcome research, which also impacts the evolution of conversations and strategies about change and change processes in music therapy. In this article, we attempt to bridge this gap and ground our argument in psychotherapy, creative arts therapies, contemporary medicine, bio-psycho-social theoretical model.

Although the trajectory of the study and theory of change in music therapy has been limited and fragmented, it has begun. de Witte et al. (2021) discovered a body of knowledge that supports certain specific therapeutic factors, such as the physical act of music making, the safe and structuring (organizing) nature of music itself, that music therapy enhances the therapeutic alliance and group processes via musical interactions and play. Furthermore, other factors that ground music therapy toward the study of and theory of change show the importance of the shared musical experiences that occur in particular, group contexts (Pasiali, 2012; Porter et al., 2017), musical attunement (McDermott et al., 2013), musical synchronicity (Potvin et al., 2018), and musical dialogues (Kellet et al., 2019). Intervention choices and music therapy expertise are therefore important factors in the study of change processes due to their potential for the activation of memories and triggering of events (Bibb & McFerran, 2018). A pragmatist-constructivist philosophical perspective toward how we seek knowledge is therefore required, one that considers music therapy in a range of contexts (Rolvsjord & Stige, 2015).

Change processes in psychotherapy are well documented and researched (see Kazdin, 2007). Furthermore, within creative arts therapies, certain professions are

showing interest in developing strategies for researching change. For example, Koch and colleagues (2017, 2019) conducted a meta-analysis on psychological outcomes in dance/movement therapy as well as investigated active factors and change processes in arts therapies. In drama therapy and psychodrama, Orkibi and colleagues (2017, 2021) have investigated topics of in-session productive behavior in adolescents working with dramatic engagement and creative adaptability conceptual framework, measurement, and outcomes in times of crisis. The profession of music therapy could benefit from building upon this research because it has potential to deepen our understanding of not just what works in music therapy, but how and why it works. Applied research, which is crucial to such developments, also requires robust theory and frameworks of change in the field's general knowledge. Similarly, the research community concerned with health and wellness could also benefit from music therapy contributions, which can further an interdisciplinary, integrative approach to the design, process, and application of the investigation of change and impact of arts as therapeutic interventions. This article presents a theoretical model and framework for interested students, professionals, and researchers who want to gain a general understanding of change process research, provide general language and a theoretical foundation. Our intention is to support and grow research knowledge of the field and build capacity in the international community across Western and Eastern perspectives, given the complexity of the cultural, creative, musical phenomena that occur within music therapy contexts globally.

From a search of the literature, we included all reviews and articles written in English on how to study change processes, and as mentioned earlier, although there are certain studies that indicate therapeutic factors in their outcomes, there were no dedicated reviews explaining what we know today about changes in music therapy (except for the scoping review about creative arts therapies by de Witte et al., 2021). Because of such a lack and a clear indication of interest in change processes from the most recent scoping review in 2021, this article presents ideas for research strategies and methodologies to explore areas of change and change processes in music therapy. As established, change related to human health and music therapy is multidimensional, and we have organized the article describing every aspect of change, reviewing research on music therapy outcomes, predictors, moderators, shapes of change, stages of changes, processes, and mechanisms of change. It is hoped that by doing so, we offer a collaborative transdisciplinary, team science approach that will innovate and advance current directions in change process research in music therapy and contribute to the wider body of knowledge on change in the creative arts therapies.

Relevance for Outcomes in Music Therapy and Change Processes

Outcome music therapy research answers if music therapy produces a change in behavior, perspectives, and/or experience. Music therapy's outcome consists of what modifications can be evaluated at the end of the treatment (macro-outcomes) or throughout the sessions (micro-outcomes). Specifically, change is often a modification of a theoretical construct, that is, something that cannot be observed directly, only inferred (Strauss & Smith,

2009). Psychopathology, well-being, distress, and attitudes are frequently investigated constructs in music therapy research, but they need indicators to be operationalized, or in other words, measured. Assessment is the evaluation of the construct's indicators and can be carried out in various ways in music therapy research. Data collection can be carried out using questionnaires, interviews, observation, clinic reports, neurological markers, or asking third persons about the patient (i.e., parents, partners, friends, teachers, physicians). To grasp more than one dimension of a phenomenon, it is better to adopt a multi-informant strategy, using more than one method (Alexander et al., 2017). Indeed, phenomena are often multidimensional and complex.

A General Introduction to the Process and Language of Outcome Research

Outcome music therapy research aims to assess the efficacy of music therapy or its effectiveness with treating a certain symptom, or set of symptoms. The researcher will begin by asking a specific research question. Once this has been developed and identified, the project will begin the process of considering the kind of approach and the best choice of design. Specifically, the efficacy is the effect of the intervention under ideal conditions where a selection of participants is based on inclusion/exclusion criteria, which is a set of items that should be met by each participant to be included in the study, and if they are not, the participant is deemed to be not a good fit and is thus excluded) and trained therapists work with selected (included) participants by following a carefully designed intervention procedure that is then made into a protocol. On a less controlled level of exploring change is within clinical practice itself. In these cases, effectiveness is the treatment effect in ordinary circumstances that reflects the clinical practice that is being carried out. Participants are selected on less strict criteria, and therapists do music therapy as they usually do (Howard et al., 1996).

Designs can be experimental or quasi-experimental. In experimental designs, participants are enrolled in these groups randomly, whereas in quasi-experiments, they are not assigned randomly. In both types of designs, the experimental groups do the music therapy intervention, which can have corresponding control groups. These groups are usually assessed pre/posttest or at a follow-up (e.g., 3 months after the posttest). The use of control groups avoids confounding variables, but sometimes it is impossible to rely on them (i.e., lack of money, time, participants). Hence, researchers can opt for open clinical trials, designs without control groups (for further information on experimental designs, see Kazdin, 2009; Lutz et al., 2021).

Designs with groups of patients rely on a nomothetic approach, that is, measuring change between subjects to formulate a general law and considering every deviation from that law as an error. Conversely, single-case studies focus on an idiographic approach, that is, measuring change within each individual to create local rules that are applicable to a few subjects (Hermans, 1988). Typical statistical analyses of experimental or quasi-experimental designs are analysis of variance (ANOVA), analysis of covariance (ANCOVA), and multivariate analysis of variance (MANOVA), which compares the means between and within groups. However, these analyses cannot be

performed in single-case studies since they have few participants who have undergone many sessions. Time series analysis (TSA) can be performed to see significant trends or to estimate every patient's rate of change. Furthermore, the reliable change index (Jacobson et al., 1984) can be calculated for every person, establishing if a clinical and significant change has happened.

Reviewing outcome research, music therapy produces a change. Indeed, many randomized controlled trials (RCTs) and meta-analyses have shown that music therapy makes a change in various contexts. For example, music therapy is effective for patients with depression (Aalbers et al., 2017; Leubner & Hinterberger, 2017; Zhao et al., 2016), anxiety (Chang et al., 2015; Lu et al., 2021), schizophrenia (Jia et al., 2020; Mössler et al., 2011), sleep (Feng et al., 2018; Loewy et al., 2013), and substance use (Hohmann et al., 2017) disorders. Furthermore, music therapy can reduce distress and pain levels in adults, premature infants, and subjects under surgery or palliative care (de Witte et al., 2020; Porter et al., 2017; Song et al., 2018; Standley, 2002); it promotes well-being and decreases psychopathology levels in dementia, such as anxiety or depression (Chang et al., 2015). Finally, music therapy can be also an intervention for the family, for example, to enhance adaptive communication (e.g., Pasiali, 2012).

When Change Happens: Role and Function of Moderators in Music Therapy

Music therapists are focused on giving the highest quality interventions, consulting, outcome research, and evidence-based practice. This choice is usually guided by a hierarchy of evidence where RCTs are considered at the top and single-case studies are at the bottom of the pyramid (Bradt et al., 2013). However, this approach neglects individual differences as a crucial component of the outcome, such as musical alliance, musical interactions, musical attunement, safe and structuring nature of music, music preferences, coping strategies, social support outside the therapy setting, and so on. In addition, patients are immersed in a context that influences the outcome. Specifically, Rolvsjord and Stige (2015) identified three contexts: the surroundings of music therapy or where the intervention is performed (in context); the mutual influences in the music therapy setting such as therapists, patients, caregivers, medical staff (as context); and the relationships between systems in and outside music therapy, such as society, community, the health-care politics or the physical environment (as interacting context). Therefore, we cannot assume that patients are identical and change in the same way. We need to be able to understand which intervention works for that patient, with that problem, at that moment, in that context.

Moderators are patients' characteristics that allow understanding when change happens and for whom. In addition, studying moderators permits knowing which type of patients respond well to a specific treatment (Kazdin, 2007). Statistically, moderators are predictive variables. However, while predictors are only associated with music therapy's outcomes, moderators predict the outcome differently when music therapy approaches are different (e.g., receptive versus active). For instance, if patients with worse interpersonal functioning have more positive outcomes in intersubjective

music therapy than in psychodynamic music therapy, the functioning is a moderator. Conversely, if lower interpersonal functioning predicts a bad outcome in every music therapy approach, it is a predictor. Hence, moderators are variables that can predict music therapy's outcome and influence the treatment-outcome relation's strength and direction (Preacher et al., 2007).

A Framework to Study Music Therapy Moderators

We propose a framework to study moderators in music therapy based on the literature (e.g., Ghetti, 2012; Kazdin, 2007). First, researchers can benefit from knowing what variables could influence the outcome or the treatment-outcome relationship when a study is designed. Ghetti (2012) proposes three multifaceted moderators in music therapy for intensive care settings that can be partially generalized to music therapy in general: personal variables (e.g., personality traits, psychopathology levels, coping skills, music preferences), demands of intervention (e.g., activities, medications) and contextual variables (e.g., therapy setting, presence or absence of caregivers). Furthermore, such moderators have to be assessed in the data collection phase. Regarding data analysis, moderators and predictors can be included in factorial ANOVA, ANCOVA, MANOVA, or regressive models as interactional effects (treatment × predictor). For example, Burns et al. (2018) included the locus of control and the sense of coherence in ANCOVA as moderators, establishing that they influenced music therapy outcomes.

In music therapy, the most studied predictors are the music therapy techniques, followed by the patient's characteristics. For instance, the reproduction technique predicted a better outcome than productive and receptive ones (Mössler et al., 2012). In addition, discipline-specific techniques (e.g., improvisation, songs, verbal reflection) predicted a better outcome than music therapy, including other media (e.g., play therapy elements, no music material) (Gold et al., 2007). Regarding patients' characteristics, lower functioning and higher psychopathology levels predict worse outcomes, and more music therapy sessions are needed to achieve an improvement (Gold et al., 2009). Conversely, examples of moderators in music therapy literature are not easy to find. A potential issue is that studies investigating if music therapy produces a change do not consider the patients' characteristics in their moderation analysis. For instance, de Witte et al. (2020) carried out a meta-analysis to study stress reduction by music therapy. Although this study was an innovative interdisciplinary project, they considered only moderators of the intervention effect. Patients' characteristics were not inserted in the moderation model, which future developments in this kind of study would be extremely useful because it would create the possibility of understanding when and for whom music therapy works. Although a trend in the scholarly dialogue is showing an extremely small interest in change process, it appears that, currently, there are no published systematic reviews or meta-analyses that investigate the role of a variable as a moderator in music therapy [an exception is Ghetti's (2012) scoping review for music therapy in intensive care]. Hence, trials and meta-analyses studies that include moderators in their analysis, which indicates a 'good design and strategy habit, would benefit research.

How Change Happens

Another problem on relying only on RCTs and focusing only on outcome research is neglecting the personal stories behind each patient. Every patient has a personal and unique trajectory of change during music therapy. Indeed, most music therapy research is often based on experimental designs that consider capturing data points for only a patient's first and last observation. Furthermore, ANOVA and MANOVA are statistical analyses that work on the groups' means, treating the deviations from the averages as an error or unexplained variance. However, these deviations represent the personal trajectories of each patient. Indeed, it is unrealistic to assume that each patient changes the same way as the others (Molenaar, 2009; Molenaar & Campbell, 2009). For instance, while pre/posttest differences were not significant, individual trajectories showed a significant change in the communication capabilities of patients affected by dementia and treated with music therapy (Schall et al., 2015). Moreover, change is a process that develops on time. Its shape can be modeled by only considering time as a variable. However, music therapy research often relies on ANOVA or MANOVA, which analyzes only scores at the beginning and at the end of the treatment. These analyses ignore the information between the pretest and the posttest, treating time as a fixed variable and losing the ability to see the shape of patients change over time (Hayes et al., 2007; Laurenceau et al., 2007). Conversely, focusing on how change happens permits us to consider the shape and the individual trajectories of change in patients during music therapy. Furthermore, the change course can be modeled by stages or steps representing the phase of treatment, frequency, and clinical contexts in music therapy. Therefore, change shape and course will be discussed to outline how to strategize and design change process research in music therapy.

Shapes of Change

Studying the shape of change processes informs how change happens in music therapy, such as the period with the most change, how gains are maintained, how fast the patients improve, and so on (Laurenceau et al., 2007; Owen et al., 2015). Studying the shapes of change also reflects the developmental stage of music therapy research and the need to create global strategies to scale up projects that can include change process research for certain populations.

Change is often treated as a linear process considering only pre/posttest scores, treating time as a fixed variable. Conversely, change is a dynamic phenomenon since its shape evolves through time (Salvatore & Tschacher, 2012). Moreover, moments of gain, loss, and impasse intertwine during the treatment in music therapy. These change patterns could assume the form of nonlinear trends, such as quadratic, cubic, and saw teeth, which cannot be modeled if only pre/posttest information is available (Hayes et al., 2007). Evidence of nonlinear patterns of change in music therapy can be found in the literature, but it is related strongly to autonomic nerve function. For instance, the trajectories of patients' heart rate variability and blood volume pulse amplitude to receptive music therapy in palliative care showed a cubic trend

(Warth et al., 2016). Similarly, Ribeiro et al. (2018) found that changes in depression and anxiety levels were nonlinearly associated with HRV for premature infants' mothers. In addition, cardiac autonomic function in patients with major depressive disorder and generalized anxiety disorder changed nonlinearly (Islam & Ferdousi, 2019; Teckenberg-Jansson et al., 2019). However, the available literature focuses on physiologic indexes, overlooking other central constructs (e.g., psychopathology, well-being).

Stages of Change and Possibilities for Transtheoretical Models in Music Therapy

There are various theories about the stages of change in psychotherapy (e.g., Howard et al., 1986; Krebs et al., 2018; Prochaska & Diclemente, 1986), but as the evidence in the current literature suggests, none have been tested in music therapy. Moreover, no specific musical tested theories describe or explain the stages of change. The first way to address this issue is to build a new theory tested for every music therapy approach; the second consists of importing existing theories in music therapy from other sciences. For instance, the transtheoretical model (Prochaska & Diclemente, 1986) articulates the change in five steps: pre-contemplation (i.e., no intention to change and no perception of problems), contemplation (i.e., interest in changing but no taken action), preparation (i.e., will to change shortly), action (i.e., change strategies are implemented), and maintenance (i.e., consolidation of change and relapses' prevention). Similarly, the phase model (Howard et al., 1986) identifies three stages: remoralization (i.e., well-being increases), remediation (i.e., symptom decreases), and rehabilitation (i.e., life functioning improves and maladaptive behaviors/cognitions are less severe).

The transtheoretical and the phase models have been tested in psychotherapy research (e.g., Hilsenroths et al., 2010; Krebs et al., 2018; Norcross et al., 2011; Stulz & Lutz, 2007), and they could also be applied in music therapy research to model the change over time, regardless of the musical approach. For instance, Silverman (2011) investigated how music therapy could enhance some states of change more than others. He showed that participants in the rockumentary and recreational music therapy conditions had higher readiness to change than participants in the verbal therapy group. Indeed, participants in rockumentary and recreational music therapy had more probability of being in the contemplation or action stage than patients in verbal therapy. Being in pre-contemplation is associated with lower readiness to change (e.g., Krebs et al., 2018). However, this association also highlighted the need for ongoing theory testing since the transtheoretical model has not been tested for music therapy, and it is unknown if it could be applied.

Systematic, Longitudinal Methods for Modeling Change over Time

We propose a framework to study how change happens in music therapy (its shapes and stages). First, the data collection and the assessment are crucial phases. Indeed, it could not be possible to adopt the statistical and mathematical analyses that are able

to model change on time without proper data, which are intensive longitudinal data (ILD). Specifically, ILD are collected over many time points and can be analyzed statistically to model the change over time of a phenomenon. For example, Schall et al. (2015) collected interpersonal behavior indicators for six months of every music therapy session. However, change happens in a context that should be considered. For this aim, ecological momentary assessment (EMA) (Shiffman, 2009) permits the collection of ILD and captures the patient's experience in their natural habit through diaries, notes, wearable devices, or smartphone apps. Temporal resolution increases and can be regulated based on the assessed variables (e.g., seconds for heart rate, days or weeks for well-being level). EMA is usually integrated into systematic single-case designs. However, it is also possible to project multiple assessments in experimental studies like RCTs (e.g., every session or every month). Obviously, EMA can be a burden for patients and therapists since it is time-consuming and expensive. Statistically speaking, multilevel modeling (MLM), TSA, and growth curve models (GCM) could be applied subsequently to obtain personal trajectories. Moreover, MLM and GCM can differentiate the rate and the speed of change between patients (e.g., Warth et al., 2016). In addition, TSA permits the evaluation of whether a trend of change is significant over time and if some events (like the beginning of a treatment) have influenced the shape of change (see Figure 1 for a TSA example).

The major problem is that there is no systematic research on the study of change trajectories in music therapy. Hence, it is impossible to review the trajectories or the patterns of change as Koffmann (2018) did for psychotherapy research. Practically, we know that change happens, but we still do not know how, that is, its course over time. As already said, this could be due to the overlook of time and reliance on nomothetic methods based on a sort of "pre/posttest philosophy."

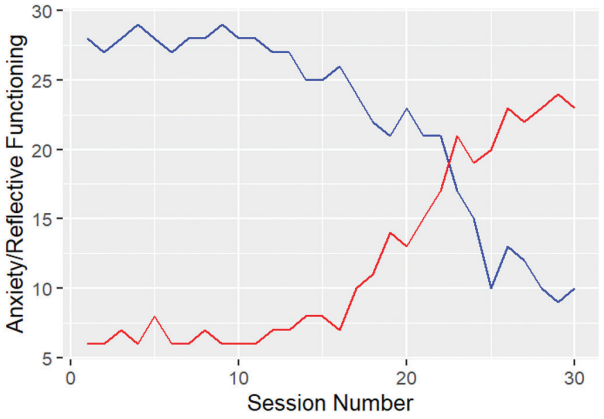

FIGURE 1 | Multivariate time series plot of anxiety and reflective functioning level. The figure represents a time plot of the levels of anxiety (blue line) and reflective functioning (red line) as a function of time-coded as the number of music therapy sessions (x-axis). Data are invented for illustrative purposes.

Why Change Happens

The last aspect that we want to introduce about change is why patients change in music therapy. Many authors have tried to formulate theories about why change happens. Specifically, theories are a set of definitions, constructs, and propositions for explaining and predicting phenomena (Kerlinger, 1973). Indigenous theories originate from music therapy practices (Aigen, 1991), and outside theories are an integration of different approaches from music therapy (e.g., psychological, physical). Although research, practice, and theory should be strictly linked together, many theories about music therapy try to identify change processes or mechanisms without testing them empirically. For instance, Hillecke et al. (2005) have theorized five change factors: attention modulation, emotion modulation, cognition modulation, behavior modulation, and communication modulation. However, although every single mechanism can be associated with music therapy's outcome, no one has ever been tested statistically to verify if it is a process or a mechanism of change. Similarly, Haslbeck (2014) has adapted creative music therapy (CMT) to preterm infants. Haslbeck explained the CMT's change action through the synchronization between the music played by the therapist and the vital signs of the preterm infant. However, this association has never been verified, and it is impossible to know if this kind of attunement is a process or a change mechanism. Therefore, first, attunement between therapists and preterm infants should be measured. Then, it should be related to the physiological indexes. These are only two examples in music therapy research, but the literature contains many untested theories. Therefore, researchers should implement a specific framework to verify processes and change mechanisms. We have tried to build one reviewing psychotherapy research and integrating with the most advanced statistical and mathematical methods (e.g., Baron & Kenny, 1986; Doss, 2004; Falkenström et al., 2020; Kazdin, 2007; Kraemer et al., 2002).

Processes and Mechanisms of Change

Processes and mechanisms of change must be introduced to understand why change happens in music therapy. We define the process of change as every intrapersonal or interpersonal event that happens during the music therapy session and causes a significant change in the patient. We use the term "significative" because not everything that happens in music therapy causes a change (e.g., the music therapist moves a painting in the room, and the patient does not notice it). Doss (2004) has derived the change processes into two categories. Therapy processes of change are the characteristics of the intervention that could lead to a modification in the patient, for example, monitoring thoughts while playing music. Instead, client processes of change are the effective modifications that happened in the client that processes of change has done, for example, acquiring a different way to monitor the thoughts. Processes of change influence the outcome indirectly through the mechanisms of change, that are, intermediate changes in the client that are not under the influence of the music therapist (see Figure 2). Mechanisms of change stand outside the music therapy, while change processes happen inside the music therapy session.

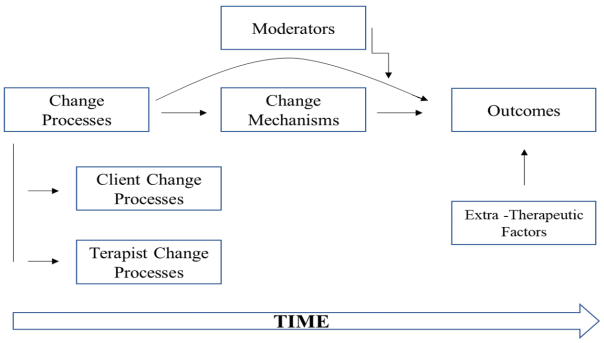

FIGURE 2 | Music therapy change.

For example, alliance, attunement, flow, and meaningfulness have been investigated as change processes (Mössler et al., 2019, 2020; Silverman et al., 2016). Regarding alliance/attunement as predictors of the outcome in music therapy, results are contradictory [e.g., see Mössler et al. (2020) for a significant association and Mössler et al. (2019) for an insignificant one]. Flow could be a change process, but it is impossible to consider it a mechanism yet (Silverman et al., 2016).

Integrating the Knowledge: A Strategy to Study Change Processes and Mechanisms in Music Therapy

First, change processes and mechanisms have to be identified. This step can be achieved using music therapy theory, as discussed in this article, or mixed methods research (MMR). Indeed, MMR aims to integrate quantitative and qualitative data through merging or connecting processes (Bradt et al., 2013). Data are collected independently and integrated with the discussion section in the merging process (convergent parallel design). This strategy is helpful when phenomena have to be studied from multiple perspectives. For instance, Barry et al. (2010) investigated music therapy's effectiveness in reducing cancer patients' distress through a questionnaire and their treatment experience through open questions. After carrying out the quantitative and qualitative analyses separately, the data were integrated with the discussion section. Conversely, findings of a phase of analysis are used for a subsequent phase in the connecting process (explanatory sequential design). For example, Lindenfelser et al. (2011) quantitatively measured the impact of music therapy on the quality of parents' lives whose children were at the end of their lives due to an incurable disease. Subsequently, the qualitative phase involved interviewing parents about their experiences related to the treatment, allowing a better understanding of which music therapy process impacted more in their life. Vice versa, the patient and therapist could be interviewed on what triggered the change in music therapy in the qualitative phase. Subsequently, a quantitative study could collect data by treating these discovered change processes as new variables to be analyzed statistically. However, MMR in music therapy is still in its infancy, as

evidenced by the fact that only a few dozen studies on it have been published, prompting Bradt (2021) to ask where the mixed studies are in the literature.

Then, change processes and mechanisms must be operationalized and assessed by including frameworks, as we have offered in the article. Since a change mechanism mediates the change process—outcome relationship, the mechanism has to precede the outcome temporally (Kazdin, 2007). Therefore, multiple assessments of these variables over time have to be done to know if there is this precedence. Indeed, both single-case and group designs can be used provided that ILD are obtained for the subsequent statistical analysis. Furthermore, it is possible to implement component studies where the experimental group undergoes the complete treatment. In contrast, the confronting group does the intervention without the investigated component, in this case, the change mechanism. After data collection, data analysis is needed. Although explaining every statistical analysis for processes and mechanisms of change research is not the purpose of this article, we briefly reviewed some of the most used methods. Statistical analysis can be basic, like using regressive models (e.g., Baron & Kenny, 1986; Kraemer et al., 2002), where several conditions must be met to consider a variable as a mechanism. Specifically, the intervention has to have an independent effect on the mechanism and the outcome. Moreover, the mechanism has an impact on the outcome. Finally, some authors require that the intervention's effect decrease or is suppressed if the mechanism is controlled statistically (e.g., Baron & Kenny, 1986), whereas others do not (e.g., Kraemer et al., 2002). Furthermore, more advanced statistical methods are available but have not been applied to music therapy research. Some examples are the cross-lagged panel model (Falkenström et al., 2020), and the random intercept-cross-lag panel model (Mulder & Hamaker, 2020). Moreover, advanced TSA can display the relationships among processes, mechanisms, and outcomes through time, verifying if a change in variables is antecedent to another (see the example below).

To summarize, Kazdin (2007) has identified six criteria to define a change mechanism: statistical association, temporality, plausibility (i.e., its functioning is explained by theory), experimental manipulation, gradient (i.e., its effect depends on how much it is implemented), and consistency between studies. Music therapist researchers can use this to build on what knowledge exists and continue to inquire if a variable meets every criterion before actually calling it a change mechanism. Moreover, these six criteria help evaluate those kinds of studies. For instance, Silverman et al. (2016) found that flow predicted readiness to change and hope, while meaningfulness was not a significant predictor for adults in an acute care mental health unit (study 1) and adult inpatients in a detoxification unit (study 2). Hence, flow could be considered a change process, but Silverman and Baker (2018) hypothesized it could be a change mechanism. However, it should be tested statistically. Indeed, Silverman et al. included flow in a regression model as a predictor of readiness to change and hope. Although its beta coefficients were significant, the Silverman study did not verify if flow predicted the outcome. Furthermore, since there has been only one evaluation of the variables, the temporal precedence between change in flow levels and change in outcomes could not be demonstrated. Similarly, Baker et al. (2015)

denominated flow and meaningfulness as mechanisms of change for self-concept and well-being. However, only the correlations of these variables with the outcomes have been calculated. Indeed, they admitted in the discussion section that regressive models are needed to establish these variables as mechanisms. Kim (2012) followed the procedure of Baron and Kenny (1986) showing how collective self-esteem partially mediated the job satisfaction-emotional exhaustion relationship. Although this study did not investigate a change mechanism since music therapy outcome was considered, it can be a guide for the mediation analysis procedure. Although these studies push the boundaries for music therapy change process research, they also highlight the need for further strategies and knowledge on what, how, and why change process research is beneficial. As noted in the 2021 scoping review by de Witte et al. (2021), there is also a need for clarity of language, tools, strategy, and approach to change in music therapy and the wider field of creative arts therapies.

A Music Therapy Theoretical Single-Case Example

We introduce a single case to illustrate introductory research concerning change processes. Suppose a client undergoes 30 sessions of music therapy. In the first sessions, the music therapist conducts the assessment, establishes the alliance, and agrees on the objectives with the patient. We hypothesize that one mechanism of change is reflective functioning, allowing the patient outside the session to mentalize his or others' mental states. Mentalizing allows for greater emotional regulation and, consequently, a reduction in anxiety levels. The music therapist's songwriting technique focused on creating a song that contains information on the patient's emotional states and how others react emotionally toward them. The music therapist starts using songwriting after ten sessions. Thus, the change process involves the therapist eliciting emotional processing through songwriting. The mechanism of change is the patient's reflexive functioning, a variable that certainly changes not during the session but outside it. In turn, change in reflexive functioning influences anxiety symptoms over time.

Once this relationship has been hypothesized, it is necessary to collect data not only pre-post therapy but in an intensive longitudinal way. We imagine that the patient answers a questionnaire at the end of each music therapy session with questions that operationalize anxiety and reflective functioning levels. Then, it is possible to create a multivariate time series and analyze it to verify whether (a) songwriting modifies anxiety and reflective functioning levels compared with when it is not practiced; (b) reflective functioning negatively affects anxiety levels: as the former increases, it decreases the second one (see online supplementary material for R codes and the database). From the outputs, it is possible to observe that the effect of songwriting is significant and that changes in levels of reflexive functioning predict changes in anxiety over time. Specifically, levels of anxiety and reflective functioning fluctuated over the first ten sessions. From the eleventh session, the music therapist carries out the songwriting. Anxiety levels decrease until the thirtieth session, while the levels of the reflective functioning increase until the end of the treatment (see Figure 1).

TABLE 1 | Vector Autoregression Analysis

$RF \leftarrow RF_{t-1} + Anxiety_{t-1}$	Estimate	SE	*t*	*p*-Value
Intercept	7.23	6.26	1.15	.259
Anxiety	–0.20	0.18	–1.08	.290
Reflective functioning	0.82	0.18	4.43	<.001
$Anxiety \leftarrow RF_{t-1} + Anxiety_{t-1}$				
Intercept	16.11	6.14	2.63	.014
Anxiety	0.52	0.18	2.92	.007
Reflective functioning	–0.51	0.18	–2.83	.009

This table shows the vector autoregression model made by two submodels: (a) reflective functioning predicted by its lagged version and the lagged anxiety ($RF \leftarrow RF_{t-1} + Anxiety_{t-1}$); (b) anxiety predicted by its lagged version and the lagged reflective functioning ($Anxiety \leftarrow RF_{t-1} + Anxiety_{t-1}$).

The analysis of interrupted time series[1] responds to the first hypothesis. Anxiety and reflective functioning levels are statistically different before and after songwriting initiation [$F(28, 1) = 16.36$, $p < .001$; $b = 8.50$, SE = 2.10, $t = 4.05$, $p < .001$]. Regarding the second hypothesis, vector autoregression analysis shows that the cross-regression[2] between anxiety and reflective functioning is significant: as reflective functioning changes over time, anxiety levels decrease during sessions (see Table 1). However, anxiety change does not predict a change in reflective functioning.

This simple single-case study aimed to illustrate a new way of working. Considering Kazdin's six criteria, the design satisfied all criteria except experimental manipulation and consistency between studies. Therefore, a subsequent step to our single case is to replicate the study in an RCT with the same structure, comparing the change of the two constructs over time in the experimental group with the control group. Finally, we know that music therapy is complex, and there is not only one change process and one change mechanism. Therefore, researchers can add every change process and mechanism to create the most exhaustive and parsimonious model that responds to research questions.

Conclusion

Change is a unique and multifaceted phenomenon of music therapy, and a single article cannot fully explain it. However, this introductory overview with a proposed model and example aimed to introduce and explore the various aspects of change, how to study it, what we know, what we do not know, and what we need to know about it. New studies about the efficacy of music therapy have been made in recent years, but it only tells a limited part of the overall story. The existing literature is

1 Interrupted time series analysis investigates the influence of an event on the time series of a variable. Specifically, whether songwriting changes trends of anxiety and reflective functioning levels.

2 The anxiety variable is regressed on a lagged version of itself and on the lagged version of reflective functioning. In turn, reflective functioning regressed to its lagged version and to the lagged version of anxiety.

extremely limited about predictors, moderators, shapes of change, stages of change, processes, and mechanisms in music therapy research. Further studies are needed for every aspect of change, and replication studies should be conducted to ensure that results are not biased.

Moreover, multiple change aspects in music therapy are an exciting means of investigation because, when carried out simultaneously, links can be created between the change's study areas: if, when, how, and why (see Figure 2). For example, by investigating whether musical synchronicity mediates or moderates (or both) within the well-researched therapeutic relationship within music therapy improvisation contexts, powerful findings may be gleaned. Dynamic systems theory (DST) could be used to model music therapy change processes as elements of a complex system that evolves over time. DST would allow for more aspects of change and more variables to be considered simultaneously, reflecting the complexity of the therapy (for an application of DST to music therapy, see [masked authors]).

Music therapy research would benefit from building on the existing knowledge as well as following the advice of Hillecke et al. (2005) to adopt a pluralistic approach, integrating the methodologies of natural sciences (e.g., biology, medicine), mathematics (e.g., statistics, physics), arts (e.g., music, musicology), behavioral and social sciences (e.g., psychotherapy, psychology, sociology). Indeed, since music therapy uses music to treat individuals in clinical contexts, methodologies (e.g., data collection, assessment, design) to evaluate intervention or to understand how a treatment works can be imported from psychotherapy, biology, or medicine. Statistics can offer more sophisticated models to capture change and its processes. Physics can teach us to insert time in the statistic models to represent the evolution of change over time. All of these contribute toward a further understanding of what moderates and mediates change in exciting new complex ways of design such as mixed methods. In conclusion, only complex methods can model complex phenomena.

About the Authors

Lorenzo Antichi is a psychologist affiliated with the University of Florence, Italy. He is the author of publications concerning theoretical and methodological aspects of Clinical Psychology, Psychotherapy, and Music Therapy, especially the change processes, idiographic methods, and longitudinal analysis.

Author to whom correspondence should be addressed; E-mail: lorenzo.antichi@unifi.it. ORCID ID: https://orcid.org/0000-0002-2479-033X.

Rebecca Zarate is the Associate Dean for Research in the College of Fine Arts and Director of the Arts & Health Innovation Lab at the University of Utah. She is the author of Music Psychotherapy and Anxiety in Social, Community, and Clinical Contexts. Dr. Zarate publishes and presents on topics related to trauma, anxiety, stress response systems, and musical/creative processes in clinical improvisation CAT contexts. E-mail: rebecca.zarate@utah.edu. ORCID ID: https://orcid.org/0000-0003-1755-3990, Website: https://artsandhealth.utah.edu/.

Marco Giannini is an Associate Professor at the University of Florence, Italy, where he teaches Research Methods and Models of Psychotherapy. He is the author of publications that mainly concern theoretical and methodological aspects of Clinical Psychology and Psychotherapy. E-mail: marco.giannini@unifi.it. ORCID ID: https://orcid.org/0000-0003-3352-7047. Website http://www.unifi.it/p-doc2-2013-200049-G3f2a3d3132302e.html.

Conflicts of Interest

The authors declare no conflict of interest.

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