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Book · November 2021

DOI: 10.3389/978-2-88971-526-8

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THE PATIENT'S CHANGE: UNDERSTANDING THE COMPLEXITY OF THE DYNAMICS OF CHANGE AND ITS PRECURSORS IN PSYCHOTHERAPY

EDITED BY: Giulio de Felice, Reitske Meganck, Guenter Karl Schiepek and Melissa Miléna De Smet

PUBLISHED IN: Frontiers in Psychology

frontiers Research Topics

frontiers

ISSN 1664-8714
ISBN 978-2-88971-526-8
DOI 10.3389/978-2-88971-526-8

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THE PATIENT'S CHANGE: UNDERSTANDING THE COMPLEXITY OF THE DYNAMICS OF CHANGE AND ITS PRECURSORS IN PSYCHOTHERAPY

Topic Editors:
Giulio de Felice, Sapienza University of Rome, Italy
Reitske Meganck, Ghent University, Belgium
Guenter Karl Schiepek, Paracelsus Medical University, Austria
Melissa Miléna De Smet, Ghent University, Belgium

Citation: de Felice, G., Meganck, R., Schiepek, G. K., De Smet, M. M., eds. (2021). The Patient's Change: Understanding the Complexity of the Dynamics of Change and its Precursors in Psychotherapy. Lausanne: Frontiers Media SA.
doi: 10.3389/978-2-88971-526-8

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frontiers in Psychology

EDITORIAL
published: 13 September 2021
doi: 10.3389/fpsyg.2021.739727

Editorial: The Patient's Change: Understanding the Complexity of the Dynamics of Change and Its Precursors in Psychotherapy

Giulio de Felice[1,2]*, *Melissa M. De Smet*[3], *Reitske Meganck*[3] and *Guenter Schiepek*[4,5]

[1] Department of Dynamic and Clinical Psychology, Sapienza University of Rome, Rome, Italy, [2] Faculty of Psychology, NC IUL London, London, United Kingdom, [3] Department of Psychoanalysis and Clinical Consulting, Ghent University, Ghent, Belgium, [4] Institute of Synergetics and Psychotherapy Research, Paracelsus Medical University, Salzburg, Austria, [5] Department of Psychology, Ludwig Maximilian University of Munich, Munich, Germany

Keywords: change in psychotherapy, precursors of change, dynamics of change, psychotherapy process, psychotherapy process-outcome research, dynamic systems

Editorial on the Research Topic

The Patient's Change: Understanding the Complexity of the Dynamics of Change and Its Precursors in Psychotherapy

It is really a great pleasure for us to introduce this Research Topic focused on the dynamics of change in psychotherapy. This Research Topic hosts contributions by authors from different parts of the world. We thank them for giving us the opportunity to learn from their latest research and clinical reflections. The specific theme of this Research Topic is a pivotal and pressing question in psychotherapy research: What are the processes that promote change in psychotherapy and what are their precursors? The scientific literature, up to now, has no coherent and univocal answer to this matter. Therefore, this Research Topic presents systematic and wide-ranged analyzes related to these questions. In this editorial, we extract some common characteristics present in the empirical and clinical research of the contributors, with the aim of providing a clearer picture of the dynamics of change in psychotherapy.

First, a contribution from Austria and Germany by Bachler et al. brings the results of an empirical study on 48 multi-problem families. They performed a home-based family therapy, consisting of one or two face-to-face sessions per week over an average of 28.8 months. Three years after the end of the treatment, the patients were significantly improved in terms of symptoms, ego strength and social skills. From Israel, Tzur Bitan et al. present the results of their empirical study on the dynamics of change within Crisis-Focused Psychotherapy. After the treatment the patients were significantly improved in terms of symptoms and perceived impotence (what the authors call "Entrapment"). From Sweden, Werbart et al. present a thematic analysis based on interviews with patients conducted at the end of their psychoanalytic treatment. They report clinically meaningful improvements in three main domains: Work and Achievements, Love and Relationships, the Self (awareness and agency). Del Giacco et al. from Spain and Italy, present an empirical study on stable patterns of verbal and non-verbal communication between patient and therapist. In particular, they analyze the contribution of those two aspects in the construction of the therapeutic alliance with depressed patients. Our own study, which involved colleagues from Italy, UK, Austria, Germany and Belgium, de Felice et al. analyzed how four good-outcome and four poor-outcome psychotherapies evolve over time, displaying an increase in flexibility at the end of the psychotherapies of the first group. The study showed not only how to quantitatively describe psychotherapy as a network, but also identified the main principles on which this evolution is based. From Spain, the colleagues Arias-Pujol and Anguera analyzed the changes in the therapist communication

OPEN ACCESS

Edited and reviewed by:
Chong Guan Ng,
University of Malaya, Malaysia

***Correspondence:**
Giulio de Felice
giulio.defelice@uniroma1.it

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *11 July 2021*
Accepted: *10 August 2021*
Published: *13 September 2021*

Citation:
de Felice G, De Smet MM, Meganck R and Schiepek G (2021) Editorial: The Patient's Change: Understanding the Complexity of the Dynamics of Change and Its Precursors in Psychotherapy. Front. Psychol. 12:739727. doi: 10.3389/fpsyg.2021.739727

strategies during a group psychotherapy with six adolescents. Takagaki et al. present the results of an empirical study on 1,042 patients with depression in Japan, showing how the trait mindfulness is a protective factor against functional impairment and avoidance. Uniting researchers from Austria, Germany and Denmark, Schiepek et al. present an empirical comparison between seven different measures to identify phase transitions. This comparison, made on both simulated and real series, had a positive outcome showing convergent results and, thereby, allowing to reliably identify phase transitions in psychotherapy. Finally, a collaboration between experts in Italy, Germany and Austria by Gennaro et al. presents an analysis of 95 dreams occurring within a single psychoanalytic psychotherapy. Based on multiple correspondence analysis, the authors highlight the evolution of dreams in relation to the unconscious themes present within them.

We can now get back to the two main questions at the heart of this Research Topic.

Regarding the *processes that promote change in psychotherapy* we note the possibility of abstracting two essential ingredients from the presented contributions, regardless of the specific therapeutic approach. The first can be defined as *Awareness* (or Self-Reflection). It consists of making the patient aware of his/her dysfunctional relational models. The second, which we term *Restructuring Experience,* consists of offering the patient a restructuring relational experience. For example, the psychotherapist keeps on listening the patient even when he/she seems very rejecting or seems to do everything possible to break the relationship with him/her. Therefore, a Restructuring Experience can take place when we, as psychotherapists, are able to offer the patient a different and more functional way of being with us, in comparison with what the patient experienced in his/her previous relational models. The Awareness and Restructuring Experience can therefore be regarded as two essential ingredients of psychotherapy ("control parameters" according to the language used for dynamic systems) that provide the patient with the psychic energy necessary to move his/her mind from a stable and pathological relational model to a more functional one (process defined "order-to-order transition" in terms of dynamic systems).

Regarding the *precursors of change in psychotherapy* we identify two main groups of indices that are in accordance with the previous literature (e.g., Scheffer et al., 2009, 2018; Gorban et al., 2010, 2021; Gumz et al., 2010, 2012; Schiepek et al., 2014, 2017, 2020; Halfon et al., 2016, 2019; de Felice et al., 2019a,b; Olthof et al., 2019). The first group refers to those indices of *Coherence* of the psychotherapy process variables[1]. As shown in previous studies, a peak of coherence within process variables leads to a subsequent phase transition, or therapeutic restructuring (e.g., Haken and Schiepek, 2006; Scheffer et al., 2009, 2018; Gorban et al., 2010, 2021). This property has also been demonstrated in other scientific domains such as physiology, chemistry, economics. In psychotherapy, this phenomenon is observed in clinical contexts when the patient can acquire the awareness of his/her own dysfunctional relational models and is able to observe them across all important domains of his life (e.g., in the significant relations of the past, in the significant relations of the present, in work, and, sometimes, also in the sessions with the therapist). Hence, this is translated into an increase of coherence in the patient's narratives and personal history. In quantitative terms, previous studies assessed coherence in psychotherapy with the following indices, extracted from a given group (i.e., matrix) of process variables: (a) the sum of their Pearson coefficients in absolute value at a given time; (b) the percentage of variance explained by their first principal component at a given time; (c) their autocorrelation (i.e., correlation between the matrix of process variables at time *t* and the same matrix at time *t-1*). The second group of precursors of change refers to the indices of *Flexibility* of the psychotherapy process variables. Indeed, it has been shown in different studies how a peak in flexibility leads to a therapeutic restructuring (e.g., Schiepek et al., 2014, 2017, 2020; Halfon et al., 2016, 2019; de Felice et al., 2019b). Also this latter property is in agreement with results from other scientific domains outside psychology (e.g., chemistry, physics, economics). In psychotherapy, this phenomenon in clinical terms is observed when the patient, during the process of change in his/her pathological relational models, oscillates between past, more pathological, and new, more functional, but unfamiliar, organizations. Hence, this is translated into an increase in the flexibility of the patient's in-session narratives, and an easier access to elements of novelty with respect to his/her personal history. In quantitative terms, previous studies measured flexibility in psychotherapy with the following indices, extracted from a given group (i.e., matrix) of process variables: (a) the Shannon entropy applied to the distribution of their eigenvalues at a given time; (b) the Distribution X Fluctuation of one or more process variables (i.e., "Dynamic Complexity," Haken and Schiepek, 2006).

We believe the present Research Topic contributes to the existing literature by shedding light on the dynamics and precursors of change in psychotherapy.

We again thank all the authors for their contribution to this Research Topic, and we sincerely wish all colleagues a pleasant reading.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

[1]These indices can be regarded as a second-order measures derived from specific calculations performed on a specific group of process variables, regardless of whether they are physiological, relational, or linguistic variables (for details see de Felice et al., 2019b).

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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ORIGINAL RESEARCH
published: 15 November 2019
doi: 10.3389/fpsyg.2019.02600

The Role of Entrapment in Crisis-Focused Psychotherapy Delivered in Psychiatric Emergency Settings: A Comparative Study

Dana Tzur Bitan[1,2], Adi Otmazgin[1], Mirit Shani Sela[2] and Aviv Segev[2]*

[1] Department of Behavioral Sciences, Ariel University, Ariel, Israel, [2] Shalvata Mental Health Center, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel

Although many mental health centers offer crisis intervention services as part of their psychiatric emergency facilities, studies assessing outcome, and process of crisis intervention psychotherapy are scarce. One potential psychological construct that might be unique to crisis intervention psychotherapy is entrapment, a psychological construct which reflects an individual's subjective perception of being in uncontrollable, unremitting, and inescapable circumstances. In this study we aimed to investigate whether changes in entrapment affect the process and outcome of crisis intervention psychotherapy, as compared to its effect in short-term psychotherapy delivered in outpatient units. Sixty-nine patients were recruited for the study. Patients were assessed for level of entrapment, symptoms, well-being, and the working alliance at three time points. The moderating effect of the type of therapy on the associations between changes in entrapment and changes in symptoms, well-being, and the working alliance were assessed using the Hayes process script. The dynamics of change following crisis intervention psychotherapy, as well as the effect of changes in entrapment on symptomatic relief, were illustrated using a clinical vignette of a patient treated in the crisis unit. Results of the moderation analyses indicated that entrapment had a more substantial effect on symptom distress in crisis intervention psychotherapy as compared to its effect in the short-term psychotherapy. Further, the difference in the effect of entrapment across the study groups was manifested primarily in internal entrapment, whereas no moderating effect was found for external entrapment. Clinical vignettes demonstrated the dynamics through which crisis intervention psychotherapy produces changes in entrapment by offering potential outlets from internal thoughts and interpretations of life circumstances. These results suggest that entrapment is a potential underlying process unique to crisis intervention psychotherapy. Limitations, directions for future research, and clinical implications are discussed.

Keywords: crisis intervention, psychotherapy, entrapment, outcome, process

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Edited by:
Reitske Meganck,
Ghent University, Belgium

Reviewed by:
Ava Schulz,
University of Zurich, Switzerland
Danilo Moggia,
University of Barcelona, Spain

****Correspondence:***
Dana Tzur Bitan
danatz@ariel.ac.il

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *23 July 2019*
Accepted: *01 November 2019*
Published: *15 November 2019*

Citation:
Tzur Bitan D, Otmazgin A, Shani Sela M and Segev A (2019) The Role of Entrapment in Crisis-Focused Psychotherapy Delivered in Psychiatric Emergency Settings: A Comparative Study. Front. Psychol. 10:2600. doi: 10.3389/fpsyg.2019.02600

INTRODUCTION

Emergency psychiatric services have recently reported rising numbers of patients in need of immediate care (Owens et al., 2007; Torrey et al., 2012; Lester et al., 2018). This rise in number of referrals to psychiatric emergency services has led many medical centers to develop crisis intervention facilities aimed at delivering emergency psychological and medical care to patients suffering from acute distress. These crisis intervention units offer immediate and proximal interventions delivered by an interdisciplinary team of well-trained professionals in the fields of psychiatry, psychology, social work, and psychiatric nursing (Kowal et al., 2011). Although the settings, treatment approaches, and durations of intervention vary from one unit to another, most of the crisis intervention units also deliver short-term, intensive, and crisis-focused psychotherapy (see Sunderji et al., 2015 for review).

The current formulation of crisis-focused interventions began with the pioneering work of several practicing clinicians who treated survivors of catastrophic situations (e.g., Lindemann, 1944; Rapoport, 1962; Caplan, 1964). These formulations define the goals of crisis intervention to include stabilization, as reflected by the cessation of escalating distress; mitigation of acute signs and symptoms of distress; and restoration of adaptive independent functioning (Flannery and Everly, 2000). Although these are general common goals across most crisis intervention programs, the methods and techniques used to reach these goals tend to develop on an *ad hoc* basis, and are determined pragmatically in response to the patients' needs. Nonetheless, most of these techniques are not unique to crisis intervention but reflect common aspects of most psychotherapeutic practices, such as establishing a bond and an agreement on therapy goals and aims (Ewing, 1990). Thus, as crisis intervention psychotherapy shares common principles with other psychotherapeutic approaches, it can and should be subjected to scientific research using common psychotherapy research approaches.

Maybe due to the unstructured and varying nature of crisis interventions, the processes and outcomes of crisis-focused psychotherapy delivered in psychiatric emergency settings have not been sufficiently studied. Most studies assessing crisis intervention have focused on the outcomes of these interventions, and in general showed a favorable outcome. For example, Kowal et al. (2011) evaluated the effectiveness of an urgent consultation clinic (UCC) and found significant improvements in life satisfaction, overall functioning, and mental quality of life. Wand et al. (2012) evaluated an emergency-department-based mental health outpatient service and found decreases in patients' levels of distress. There have also been studies showing that crisis interventions tend to decrease the number of referrals to on-call psychiatrists and overnight inpatient admissions (Parker et al., 2003).

Studies assessing the underlying processes in crisis intervention psychotherapy are scarce. Most of the studies assessing predictors of change have focused on short-term psychotherapy delivered in diverse settings without isolating the crisis nature of some of these interventions. These studies found several potential processes that mediate the effect of psychotherapy on symptom relief, for example changes in defense mechanisms (Kramer et al., 2010), changes in automatic thoughts (Coleman and Casey, 2007), and changes in the working alliance (Gaston et al., 1994). These studies indicate that there are several common processes in crisis intervention psychotherapy which are shared by most psychotherapy approaches, yet no study has previously assessed whether there are specific psychological constructs unique to crisis intervention psychotherapy.

A potential psychological construct which might play an important role in process and outcome of crisis intervention psychotherapy is changes in feelings of entrapment. Entrapment is conceptualized to reflect an individual's subjective perception of his or her circumstances as being uncontrollable, unremitting, and inescapable (Williams, 2001; Gilbert and Gilbert, 2003). The origins of this construct are grounded within theoretical accounts of high-stress circumstances where escape is motivated but blocked or prevented, and is termed "arrested flight" (Dixon et al., 1989; Dixon, 1998). Entrapment can manifest as either external or internal. External entrapment relates to the perception of events in the outside world as inducing escape motivation. On the other hand, internal entrapment relates to escape motivation that is induced by internal feelings and emotions (Gilbert and Allan, 1998).

Studies assessing the role of entrapment in psychological distress found it to be highly associated with various forms of human psychopathology such as depression, posttraumatic stress disorder (PTSD), and other anxiety syndromes (Taylor et al., 2011; Siddaway et al., 2015). The construct was also previously correlated with predictive factors of depression, such as rumination (Gilbert et al., 2005). Several theoretical frameworks, as well as empirical studies, have suggested that entrapment also serves as a core psychological mechanism in the causal pathways leading from distress to suicidal crises (Li et al., 2018). In a study assessing the prevalence of factors predicting acute suicidal risk among veterans attending urgent care psychiatric clinics, 66% of the sample reported having feelings of entrapment, as identified by their reports of feeling entrapped and with no way out (McClure et al., 2015). These findings suggest that entrapment is associated with high distress circumstances; nonetheless, the effect of entrapment as an important psychological construct during recovery from acute crisis has not been previously examined.

In this study we aimed to assess the predictive value of entrapment on the process and outcome of crisis intervention psychotherapy delivered in psychiatric emergency settings. Our goal was to focus on the measurement of routine processes derived from daily clinical experiences of real-world practice, while employing a practice-based research paradigm (Margison et al., 2000). Specifically, we examined whether the type of treatment (crisis intervention psychotherapy vs. short-term psychotherapy) moderated the association between entrapment and distress and well-being, or affected process measures such as the working alliance. Our main interest was in examining whether there are differential predictors of change among the two interventions provided in the outpatient and the crisis unit. The study hypothesis was that changes in

entrapment would be associated with changes in outcome in the crisis intervention psychotherapy, but not in the short-term psychotherapy delivered in the outpatient units. A secondary aim of the study was to explore the differential pattern of changes in external and internal entrapment on symptom distress, well-being, and the alliance.

MATERIALS AND METHODS

Participants

Recruitment to the study was held through two main units of the Shalvata Mental Health Center: the outpatient unit, which treats the majority of outpatients, and the crisis intervention unit, which is an outpatient unit located within the psychiatric emergency department. Patients in the outpatient unit approach the unit via a personal or primary doctor referral. Patients in the crisis intervention unit approach the unit through the referral of either the primary doctor requesting immediate care, or through the referral of the attending psychiatrist in the psychiatric emergency department. Inclusion criteria included the patient being 18 years of age or older, initiation of psychotherapy as determined after an intake or a psychiatric emergency examination, and the patient's ability and willingness to participate in the study. Exclusion criteria included immediate and proximal suicidal or behavioral risk to the patient or others, or inability to complete self-report assessments.

Measures

DSM-5 self-rated level 1 cross-cutting symptom measure – adult (American Psychiatric Association, 2013). A self-report measure aimed to assess psychiatric symptoms across 13 domains: depression, anger, anxiety, mania, somatic symptoms, suicidal ideation, psychosis, sleep disturbances, memory, repetitive thoughts and behaviors, dissociation, personality functioning, and substance use. The measure consists of 23 questions about symptoms experienced in the previous 2 weeks. Participants are requested to rate the extent to which they have been bothered by these symptoms on a 5-point Likert scale, ranging from 0 (*not at all*) to 4 (*nearly every day*). The measure was found to have good psychometric properties (Narrow et al., 2013). In order to evaluate total psychopathology severity, total scores were calculated to produce an index of psychopathology. The alpha coefficient in the current sample indicated good internal reliability (Cronbach's alpha = 0.87 at baseline).

Outcome questionnaire (OQ-45; Lambert et al., 1996). A self-report measure designed to assess patient outcomes during the course of therapy. The scale assesses three primary dimensions: (a) subjective discomfort, (b) interpersonal relationships, and (c) social role performance. The measure is widely used and has been shown to have good internal consistency (0.93), 3-week test–retest reliability (r = 0.84), and concurrent validity (Snell et al., 2001). The OQ-45 was previously found to be sensitive to changes in both clinical outpatient populations, and in severely ill inpatient samples (Lambert et al., 1996; Doerfler et al., 2002). For the purposes of the current study, we used the OQ-45 as a measure assessing outcome at three time points: before, mid-point, and after therapy. The alpha coefficient in the current sample indicated high internal reliability (Cronbach's alpha = 0.91 at baseline).

Entrapment Scale (Gilbert and Allan, 1998). The Entrapment Scale (Gilbert and Allan, 1998) is a 16-item self-report instrument assessing perceptions of psychological entrapment. The scale includes two subscales, with 6 items tapping internal entrapment (perceptions of entrapment by one's own thoughts and feelings) and 10 items related to external entrapment (perceptions of entrapment by external situations). Ratings are made on a 5-point scale, scored from 0 to 5, with higher scores indicating greater entrapment. The Entrapment Scale was found to have good psychometric properties (Gilbert and Allan, 1998; Taylor et al., 2011). The alpha coefficient in the current sample indicated excellent internal reliability (Cronbach's alpha = 0.94 at baseline).

The 6-item Session Alliance Inventory (SAI, Falkenström et al., 2015). The SAI is a self-report measure of working alliance, aimed at assessing agreement between patients and therapists on treatment goals and therapeutic tasks, and at assessing the level of positive emotional bond. The SAI is highly correlated with the full version of the working alliance inventory (Horvath and Greenberg, 1994) and the working alliance inventory-short revised (WAI-SR, Hatcher and Gillaspy, 2006), and has a high reliability for the composite sum or mean of the six items (Falkenström et al., 2015). The original version of the working alliance inventory was previously found suitable for detecting weekly changes in alliance, and to be associated with changes in therapy outcome (Klein et al., 2003). The short version of the SAI was also previously utilized for the detection of changes in alliance in naturalistic psychiatric settings and was found to adequately detect such changes (Tzur Bitan et al., 2019). The alpha coefficient in the current sample indicated good internal reliability (Cronbach's alpha = 0.89 at baseline).

Schwartz Outcome Scale (SOS-10; Blais et al., 1999). The SOS-10 is a 10-item scale designed to measure psychological health and well-being. Items are rated on a 7-point Likert scale with higher total scores indicating better psychological well-being. The measure has been used in a range of settings (Young et al., 2003) and has demonstrated high internal consistency (Beard and Björgvinsson, 2014). Internal consistency in the current sample was adequate (Cronbach's alpha = 0.83 at baseline).

Procedure

The study was authorized by the Shalvata Mental Health Center Institutional Review Board (IRB), approval number 0017-17-SHA. Patients in the outpatient and the crisis intervention units were recruited by the study coordinator. In the outpatient units, patients were allocated to receive psychotherapy by the treating staff after an intake meeting. After the intake they were approached by the study coordinator, who provided information about the study. Patients from the crisis intervention unit were recruited after the initial psychiatric emergency examination. Assignment to either the crisis or the outpatient unit was based on level of urgency. Patients in need of an immediate intervention were assigned to the crisis intervention, while patients in need of non-urgent intervention were referred to the outpatient

unit. The establishment of the crisis unit was conceptualized to be practice-research oriented; therefore, assessments were delivered for clinical purposes as part of the clinical routine. Patients were informed regarding the clinical and empirical utility of the assessments and were given the choice to participate. Informed consent was waived due to the clinical usage of the assessments. Initiation of the comparative study was conducted a few months after the establishment of the crisis intervention unit. After receiving IRB approval, patients from the outpatient unit were recruited and signed informed consent. Short-term psychotherapy included integrative psychotherapy combining dynamic, cognitive, and behavioral interventions. In the crisis intervention psychotherapy, the therapists delivered crisis-focused therapy aimed to specifically address the presenting and current crisis as outlined in the Flannery and Everly (2000) review. The psychotherapeutic approach during sessions, aimed to achieve the alleviation of a psychological crisis, as specified in the Flannery and Everly (2000) review, was primarily integrative, and included elements of contemporary psychodynamic psychotherapy (e.g., Summers and Barber, 2009), as well as cognitive and behavioral elements. In both the crisis-focused psychotherapy and the short-term psychotherapy the number of sessions was up to 16, with a maximum overall duration of psychotherapy lasting 3 months. Sessions were held once a week, but in the crisis intervention psychotherapy, the frequency of sessions could have been higher as a function of the patient's needs. Therapy sessions began shortly after the intake meeting. Assessments were performed after the first psychotherapy session (baseline T1), a month and a half after the initiation of treatment (mid-therapy, T2), and at the end of the therapy (T3). Each patient was followed for a period of 3 months. The primary outcome measure was the DSM-5 self-rated level 1 cross-cutting symptom measure, while the OQ-45, and the SOS-10 were secondary outcome measures. Process measures included the entrapment scale and the SAI. Overall, the duration of patient recruitment lasted a total of 2 years (2016–2018).

Statistical Analyses

Demographic and clinical baseline differences between the outpatient and crisis intervention patients were assessed using chi square tests for categorical variables and *t*-tests for continuous variables. In order to assess the moderating effect of the type of psychotherapy (short-term psychotherapy vs. crisis intervention psychotherapy) on the association between changes in entrapment and changes in outcome, we first calculated the differences in all outcome variables from baseline to T3. For the purposes of the moderation analysis, we considered changes from pre- to post-treatment (baseline to T3) on all outcome and process measures. Mid-treatment scores were utilized for empirically assessing trajectories of change for the case report, as well as for individualized grown curves. Tests of normality were performed on all outcome and processes variables using the Shapiro–Wilk test of normality. The Hayes (2012) process script was then used to assess the moderating effect of the group (short-term vs. crisis intervention) on the predictive effect of entrapment on the various outcome measures. Bootstrap resamples were utilized to test the moderation effects in cases where normality assumptions were violated (Preacher and Hayes, 2008). All statistical procedures were conducted using SPSS version 25.

RESULTS

Participants

A flowchart of patients' recruitment process is presented in **Figure 1**. Overall, 104 patients were assessed for eligibility, out of whom 35 refused to participate. Of the total 69 patients who participated in the study, 15 patients completed all three assessments in the crisis intervention unit, and an additional 13 completed two assessments. In the outpatient units, 12 completed all three assessments, and one completed two assessments. For the purpose of the current study, we analyzed patients with at least two complete measurements, resulting in a total sample of 41 patients.

Clinical and demographic characteristics of participants in the outpatient and crisis intervention units are presented in **Table 1**. The mean age was 40.1 (SD = 14.7). Of the total number, 51.2% were men and 48.8% were women. No significant differences in age or gender were found across the study groups. The main diagnostic clusters of study participants included adjustment disorders (26.8%), anxiety disorders (26.8%), PTSDs (19.5%), depression (22.0%), and other diagnoses such as eating disorders and schizophrenia (4.9%). There were significant differences in diagnosis distribution across the two groups, reflected by a higher prevalence of adjustment disorders in the crisis intervention group as opposed to a higher prevalence of anxiety disorders in the outpatient group, χ^2 (4) = 13.58, $p \leq 0.001$. Comorbidity was diagnosed in 19.5% of the study participants; most of the patients received psychiatric medications during treatment (82.9%), with no significant differences between groups in prevalence of comorbidity or medication utilization. The average time in research was 83.80 days (SD = 49.1), with the outpatient group showing a significantly longer time in research compared to the crisis intervention group, $t(39) = -3.86$, $p < 0.001$).

Baseline Clinical Characteristics of the Study Groups

No significant baseline differences were observed among the two study groups in general symptomatology, symptom distress, interpersonal and social relations, internal and external entrapment level, or working alliance (see **Table 2**). A significant difference, $t(38) = -3.29$, $p \leq 0.01$, was found in the quality of life measure (SOS-10), indicating that the outpatient group reported higher quality of life at baseline (M = 33.32, SD = 10.67) compared to that reported by the crisis intervention group (M = 21.96, SD = 9.89). With regards to the main outcome measure (the DSM symptom measure), one patient from the crisis unit did not complete the DSM-5 measure at baseline, additional 13 patients from the crisis unit did not complete the measure at post-treatment, and one patient from the outpatient unit did not complete the measure at post-treatment. Incomplete items were excluded from analysis. Overall, patients in both units exhibited symptomatic improvements from baseline to

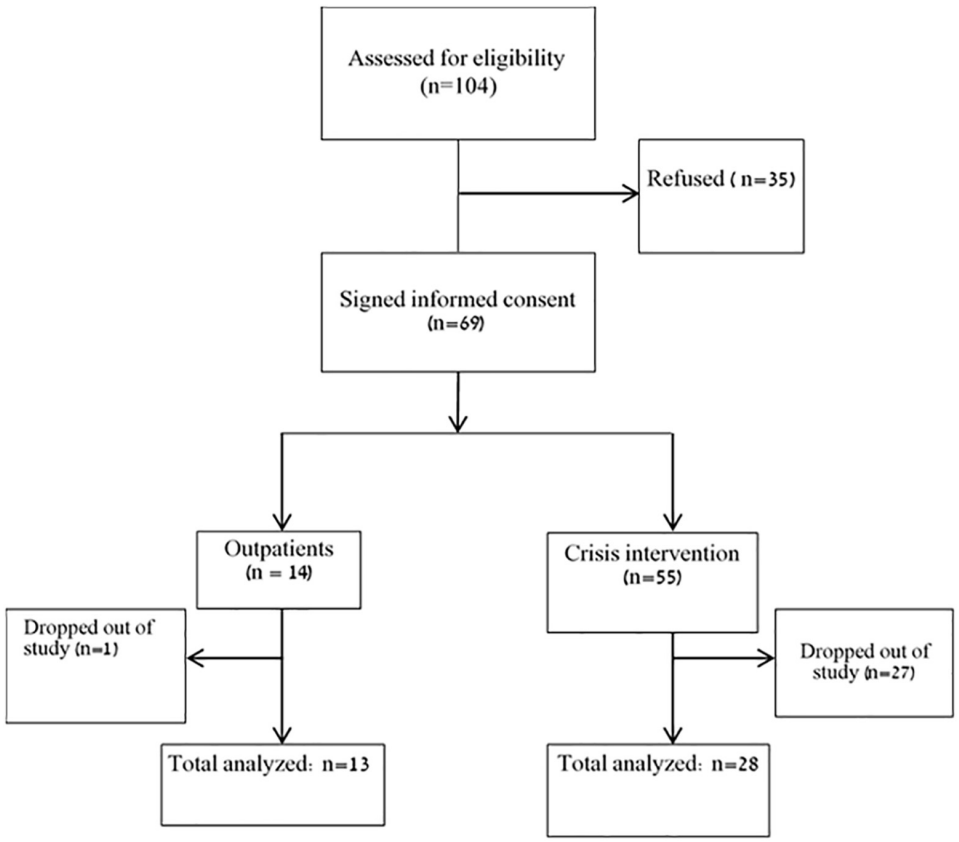

FIGURE 1 | Recruitment process of study participants.

post-treatment, as manifested in a significant change in DSM symptoms of interpersonal relations [short-term, $t(12) = 1.80$, $p < 0.05$; crisis intervention, $t(26) = 2.74$, $p < 0.001$] and hopelessness [short-term, $t(12) = 1.81$, $p < 0.05$; crisis intervention, $t(27) = 1.54$, $p < 0.05$] from pre-treatment to mid-treatment; and improvement in symptoms of worry and preoccupation [short-term, $t(11) = 1.91$, $p < 0.05$; crisis intervention, $t(14) = 3.30$, $p < 0.001$]; and social relations [short-term, $t(11) = 1.77$, $p < 0.05$; crisis intervention, $t(14) = 3.37$, $p < 0.001$] from mid-treatment to post-treatment.

TABLE 1 | Demographic and clinical characteristics of study participants.

	Crisis intervention psychotherapy (n = 28)	Short-term psychotherapy (n = 13)	p
Age (mean, SD)	42.64 (14.78)	34.62 (13.46)	0.1
Gender			0.37
Male	13 (46.4%)	(61.5%) 8	
Female	(53.6%) 15	(38.5%) 5	
Total time in research (days)	(35.57) 66.49	121.31 (54.83)	$p < 0.001$
Comorbidity[a]	(21.4%) 6	2 (15.4%)	0.65
Concurrent medication	(89.3%) 25	9 (69.2%)	0.11
Main diagnosis			$p < 0.001$
Adjustment	10 (35.7%)	1 (7.7)	
Anxiety	(10.7%) 3	8 (61.5%)	
PTSD	(21.4%) 6	2 (15.4%)	
Depression	8 (28.6%)	1 (7.7%)	
Others	1 (3.6%)	1 (7.7%)	

[a]*Comorbid diagnosis included personality disorders, attention deficit and hyperactivity disorders, adjustment disorders, PTSD, and agoraphobia.*

Moderation Analysis

The Shapiro–Wilk test of normality indicated a normal distribution of all process and outcome variables (Shapiro–Wilk statistic ranging from 0.95 to 0.98, non-significant), with the exception of the interpersonal subscale of the OQ-45 which produced a statistic of 0.88, $p < 0.01$. Results of the simple effects of all moderation analyses are presented in **Table 3**.

As can be seen in **Table 3**, for the OQ-45 total score, a marginally significant moderating effect of type of therapy was found ($B = 0.68$, $t = 1.96$, 95% CI: −0.02;1.39, $p = 0.057$), where changes in entrapment were more predictive of changes in total distress scores in the crisis intervention psychotherapy group ($B = 1.30$, $p < 0.001$) as compared to the short-term psychotherapy outpatient group ($B = 0.62$, $p = 0.054$). Moderation analyses conducted on the OQ45 subscale indicated a significant moderating effect of type of therapy on symptom

TABLE 2 | Baseline clinical characteristics of the study groups (n = 41).

Measure	Crisis intervention (n = 28)	Outpatient (n = 13)	Bootstrap 95% CI	P
Adult DSM-V symptom	35.73 (14.16)	27.23 (17.27)	−18.80; 1.80	0.10
OQ-45 general score	76.94 (28.08)	66.15 (31.59)	−30.93; 9.35	0.29
OQ-45 symptom distress	48.71 (18.79)	39.92 (22.82)	−22.67; 5.10	0.20
OQ-45 interpersonal relations	15.35 (8.58)	15.92 (7.7)	−5.13; 6.29	0.84
OQ-45 social relations	12.88 (6.75)	10.3 (5.36)	−6.93; 1.78	0.24
Entrapment Scale	34.04 (19.8)	24.62 (21.89)	−23.31; 4.47	0.18
Internal entrapment	20.86 (11.86)	14.92 (12.11)	−9.92; 2.95	0.15
External entrapment	13.18 (9.08)	9.69 (10.36)	−14.03; 2.17	0.28
SAI	35.29 (5.81)	30.54 (8.39)	−9.70; 0.20	0.06
SOS-10	21.96 (9.89)	33.23 (10.67)	3.97; 18.56	$p < 0.01$

TABLE 3 | Moderation analyses for the effect of type of psychotherapy on the association between entrapment and therapy outcomes.

		Effect	SE	T	95% CI	P
Adult DSM-V symptoms	Short-term	0.32	0.18	1.78	−0.04; 0.69	0.083
	Crisis intervention	0.62	0.09	7.19	0.44; 0.79	< 0.001
OQ45-sum	Short-term	0.62	0.31	1.98	−0.01; 1.26	0.054
	Crisis intervention	1.30	0.15	8.73	1.00; 1.61	< 0.001
OQ symptom distress	Short-term	0.45	0.18	2.42	0.07; 0.84	0.02
	Crisis intervention	0.96	0.09	10.61	0.78; 1.14	< 0.001
OQ social relations	Short-term	0.08	0.12	0.66	−0.16; 0.32	0.50
	Crisis intervention	0.15	0.05	2.56	0.03; 0.26	< 0.05
OQ interpersonal relations	Short-term	0.08	0.11	0.77	−0.13; 0.31	0.44
	Crisis intervention	0.19	0.05	3.73	0.09; 0.3	< 0.001
SOS-10	Short-term	−0.16	0.20	−0.76	−0.58; 0.26	0.44
	Crisis intervention	−0.54	0.10	−5.37	−0.74; −0.33	< 0.001
SAI	Short-term	0.16	0.15	1.06	−0.14; 0.47	0.29
	Crisis intervention	−0.09	0.07	−1.24	−0.24; 0.05	0.22

distress subscale (B = 0.51,SE = 0.20, t = 2.41, $p < 0.05$, 95% CI 0.07–0.93), indicating a significant effect of changes in entrapment on symptom distress in the crisis intervention group (B = 0.96, $p < 0.001$), and a lower significant effect in the outpatient group (B = 0.45, $p < 0.05$). No significant moderation effect was found for the other subscales of the OQ45, or for the DSM-V symptom scale, the SAI, or the SOS-10 quality of life measure. As the changes in the OQ-45 interpersonal relations subscale were not normally distributed, bootstrap confidence intervals were calculated with 5,000 re-samplings to test the moderating effect. The results indicated a non-significant interaction effect (effect = 0.11, Boot SE = 0.13, Boot 95% CI −0.08; −0.43). In order to probe the effect of type of therapy on the association between entrapment and symptom distress, we tested both internal and external entrapment on this outcome variable. The analyses indicated a significant moderation effect of type of therapy on internal entrapment and symptom distress (B = 1.09, se = 0.54, t = 2.01, $p < 0.05$, 95% CI −0.01; −2.2), according to which a significant effect of internal entrapment on symptom distress was found in the crisis intervention psychotherapy group (B = 1.94, $p < 001$), yet no significant effect of internal entrapment was found in the outpatient group (B = 0.84, p = 0.09). No moderating effect was found for external entrapment. **Figure 2** displays the simple regression slopes of the prediction of symptom distress by internal and external entrapment in the crisis intervention unit versus the short-term psychotherapy group.

The Dynamics of Symptomatic Change Following Changes in Entrapment in Crisis Intervention Psychotherapy: A Case Illustration

To provide an in-depth exploration of the dynamics of change during crisis intervention psychotherapy, as well as the clinical manifestations of changes in entrapment and their effect on symptomatic relief, we describe here a clinical course of crisis intervention psychotherapy delivered in the setting of the psychiatric emergency unit. The description demonstrates the unique features of crisis intervention psychotherapy as a tool to alleviate entrapment, and possible trajectories leading from changes in entrapment to relief of distress. All personal identifiers in the following clinical demonstration have been removed or extensively disguised, so that the patient is not identifiable and cannot be identified through the clinical description.

Victoria is a 45-year-old woman, recently divorced and with two children. In the past, she had worked as a litigator in a large litigation firm where she had interned during law school.

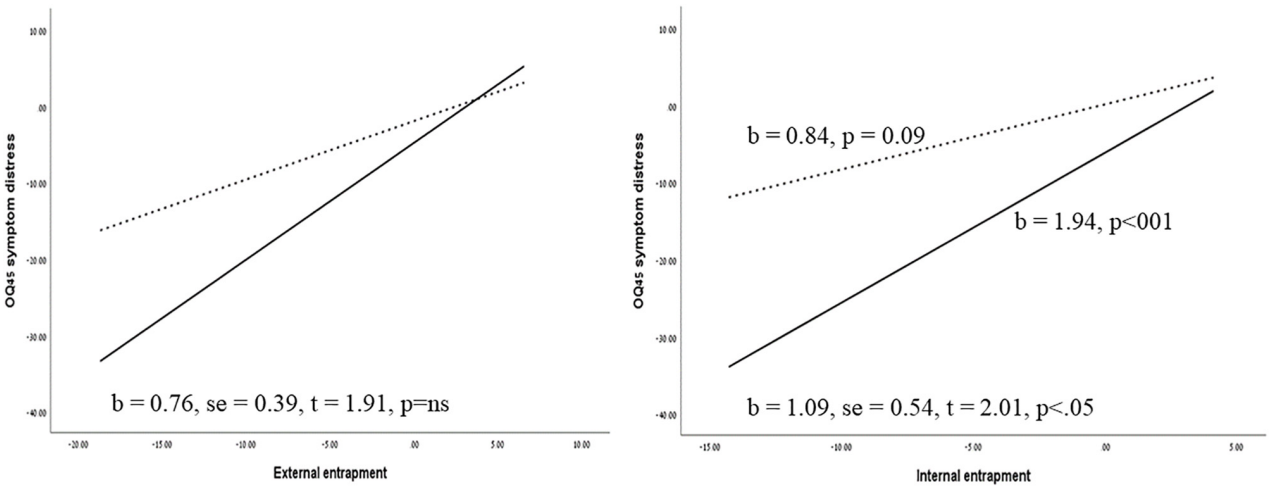

FIGURE 2 | Simple regression slopes of the prediction of symptom distress by internal and external entrapment at the crisis intervention unit versus the outpatient group. Solid lines represent the crisis intervention psychotherapy group and dashed lines represent the outpatient group. The regression slopes refer to the prediction of changes from pre-treatment to post-treatment (TI–T3).

Victoria lost her father when she was a very young child; her mother never remarried, and she mourned the death of her husband throughout most of her adult years. Victoria has one older sister, whom she described as passive and submissive. Her mother raised both of them, as Victoria described, due to her sense of obligation, but was mostly absorbed in her grief, and Victoria felt that her mother had no real interest in her. Thus, Victoria spent most of her childhood feeling unwanted, "like something you have no choice but to handle," and alone. Throughout her mature life, she constantly felt that she needed to resolve her problems on her own, and that no one had any real interest in her. When Victoria met her husband, she felt for the first time that she could trust someone else to care for and about her. This relationship enabled her to trust others for the first time, and gradually she became more socially active and made new friends. The sense of belonging and the security she felt with her husband allowed her to pursue her dream to become a lawyer, and she completed her degree successfully. Victoria and her husband had been married for 20 years, but in the last few years had struggled with issues of trust and loyalty. During these years, Victoria started to wonder whether people were truthful, and she began to question the motives of her colleagues and friends. Although she was exposed to interpersonal conspiracies and manipulative behavior at work, she tended to split her personal and professional lives and could not stand the idea that her closest friends might be manipulative or dishonest toward her. Gradually she started to distance herself from others and only confided in her closest family members. This gradual alienation from others resulted in feelings of loneliness, dissatisfaction with her work, reduced social activities, and negative mood. Victoria went to see several psychotherapists and psychiatrists, but felt that their treatment approach was either wrong or not suited to her needs. She arrived at the psychiatric ER with one of her friends, after confiding her suicidal thoughts in her, requesting that she keep her children safe. During the psychiatric examination, Victoria refused to be admitted to a psychiatric ward, but agreed to receive psychotherapy in the crisis intervention unit.

During the first session with the therapist, Victoria expressed a sense of hopelessness, a feeling that she couldn't trust others, and questioned whether the treatment could be of help. She repeatedly said that she didn't understand how talking about her problems would help her resolve them. Nonetheless, she could not think of any other alternative to help her handle her problem and stated that "coming to the ER was the only thing I could think of." Noticing the distrustful attitude, the therapist focused on the establishment of an alliance with Victoria, while stating that as dealing with the problem by herself had not produced the desired outcome, she might as well give the therapy a chance. The sessions were initially focused on the validation of her frustration and despair, but at the same time on the idea that coming to the ER was an active step that she had made to resolve her problems. In the therapeutic relations, the therapist frequently conceptualized the therapeutic sessions as a mutual and collaborative search for potential outlets for her difficulties. Therapy sessions gradually shifted to a discussion of her loneliness, as well as the contradictory feelings of wanting to be with others while simultaneously being unable to trust them. The following clinical vignette demonstrates the use of therapy as a means of resolution of feelings of loneliness, as well as the collaborative efforts to find outlets for her negative emotions:

Victoria: What I am now is very different from what I used to be. I can't recognize myself anymore.
Therapist: How so?
Victoria: I used to be a very friendly person; now I can't even engage in a discussion with my own family. I feel so distant from the conversation.
Therapist: Why is that?
Victoria: I think I'm too absorbed in my own problems. I keep on thinking: What will be the end of this mess, when will I get

better? These are issues I can't discuss with my children or with my family.
Therapist: So you say that you have no one to confide in.
Victoria: Yes. Well. . . I have you.
(pause)
Therapist: Yes, you do have me (pause). I think it's an important thing you are now noticing. And I would also like to remind you that your friends were worried about you, and they brought you here. So in a sense, the fact that you confided in them in a time of need enabled you to reach out for help and be supported.
Victoria: I did not ask them to do that.
Therapist: Well maybe you did not view them as a source of support.
Victoria: I used to tell my friends everything, but it became so complicated when I got divorced. But you are right that they are still my friends. They still call me every day, you know.
Therapist: Well, maybe if you try to reconnect with them then you will have more sources of support, and then maybe you can also find time and energy to interact with your family and friends as you did before.
Victoria: I guess I can try that.

The clinical vignette demonstrates the formulation of the therapeutic bond as a potential outlet for Victoria's feelings of having no support, as well as demonstrating the way that the collaborative endeavor enables a reconnection to feelings of vitality and importance. **Figure 3** illustrates the changes in internal and external entrapment, alliance, and symptoms in Victoria's reports. **Figure 4** presents the individualized growth curves of changes in entrapment across participants in the crisis intervention psychotherapy versus treatment as usual. As can be seen, in the crisis intervention psychotherapy the majority of the patients showed a clear reduction in entrapment, while the majority of the patients in the short-term psychotherapy did not show the same reductions.

DISCUSSION

In this study we aimed to assess the effect of entrapment on the outcomes of crisis intervention psychotherapy delivered in psychiatric emergency settings, as compared to its effect in short-term psychotherapy delivered in the outpatient unit. The results of the moderation analyses indicated that entrapment had a more substantial effect on symptom distress in the crisis intervention psychotherapy group as compared to its effect in the short-term psychotherapy outpatient group. Further, we found that the difference in the effect of entrapment across the study groups was manifested primarily in internal entrapment, whereas no moderating effect was observed for external entrapment.

Although type of therapy was only significant in moderating the effect of entrapment on symptom distress, a review of the simple slope effects indicates that entrapment had a more substantial effect on most outcome variables in the crisis intervention psychotherapy group, whereas its effect in the outpatient unit was either smaller or non-significant. These results suggest that this psychological construct, which has been associated primarily with suicidal crises, also shares common characteristics with situations of extreme distress, where a need for immediate psychological intervention arises. Theoretical models focusing on the effect of entrapment on suicidal behavior might indicate several possible shared mechanisms. For example, the "cry of pain" model suggested by Williams (2001) postulates that suicidal behavior is a response to the presence of defeat, the perception of no escape, and the perception of no rescue. Thus, the predictive effect of changes in entrapment on therapy outcomes in crisis intervention psychotherapy might represent

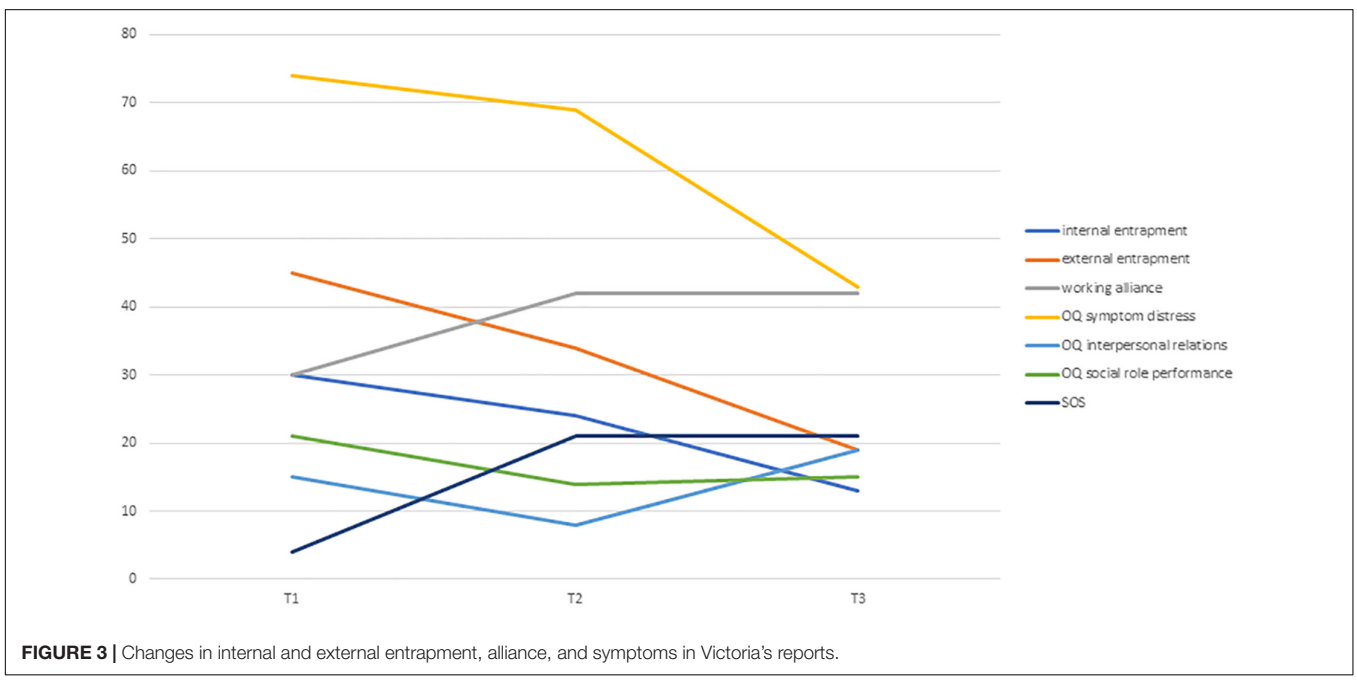

FIGURE 3 | Changes in internal and external entrapment, alliance, and symptoms in Victoria's reports.

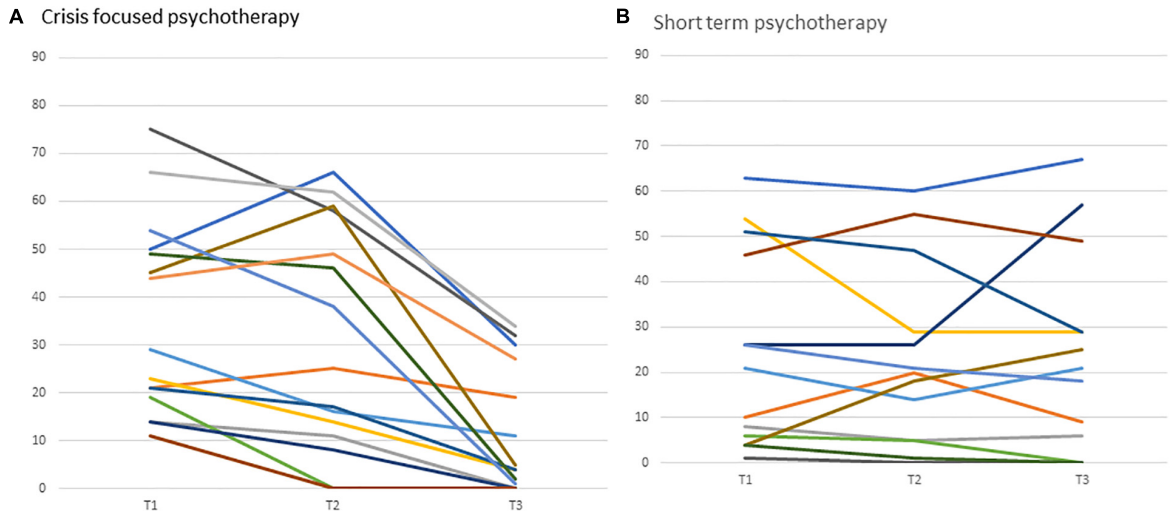

FIGURE 4 | Individual grown curves of changes in entrapment in crisis intervention psychotherapy versus usual care. Curves in panel **(A,B)** represent individual patients and their trajectory of change in entrapment from baseline (TI) to post-treatment (T3).

the perception of the therapeutic intervention as a possible means of rescue or escape from unbearable emotions. As such, it is possible that the formulation of crisis intervention, as well as the intensive attunement to the distressful event associated with the crisis, lead to a more pronounced effect of entrapment during crisis intervention, as opposed to its role in short-term psychotherapy. The case of Victoria further illustrates how a therapeutic bond in times of crisis can serve as a temporal means for escaping feelings of loneliness, as well as a secure base from which to explore different alternatives toward the resolution of origins of distress.

The association between changes in entrapment and changes in symptom distress further strengthen the conceptual importance of entrapment, as it suggests that entrapment is not only predictive of acute crises, but also has an important contribution in facilitating recovery from them. Although the effect of changes in entrapment during psychological intervention has not been previously studied, several authors have noted the need to target entrapment as a possible mediating component of psychotherapy outcomes (O'Connor et al., 2013; Li et al., 2018). According to these suggestions, entrapment can serve as a psychological mechanism which mediates the transition from suicidal ideation to suicidal attempt when accompanied by intense negative affect, loss of cognitive control, hyper-arousal, and social withdrawal. The results of the current study indicate that to a certain extent, the formulation of a crisis intervention enables the modification of entrapment, thereby reducing the intensity of negative emotions. Thus, this intervention can be viewed as a possible preventative intervention, aimed at limiting the possible negative effects of extreme distress by offering alternative paths of action. This possible trajectory should be subjected to additional research.

An additional finding that emerged from our study is that the association between internal entrapment and outcome was moderated by the type of therapy, whereas external entrapment was not. These findings indicate that the unique contribution of crisis intervention, and specifically its unique role in entrapment, is manifested by its effect on internal entrapment. The concept of internal entrapment – which conveys the feeling of being trapped within one's own thoughts and feelings – has been primarily associated with defeat (Owen et al., 2018) and rumination (Gilbert et al., 2005). These associations suggest that the essence of a crisis dominated by internal entrapment is embodied in patients' thoughts and interpretations of their life circumstances, and that entrapment occurs when the patient conceives no way out of these thoughts. The results of our study further extend these findings, as they suggest that psychotherapies targeting the current crisis might produce relief primarily by targeting this ruminative state, and not necessarily by intervening with external life circumstances.

This study has several important theoretical and clinical implications. To the best of our knowledge, this is the first study that has addressed entrapment not only as a construct predictive of psychopathology, but also as a construct predictive of psychotherapy outcome. The findings of the current study indicate that changes in entrapment are associated with changes in outcome, and that this association is evident in crisis intervention psychotherapy but not in short-term psychotherapy. These findings suggest that entrapment is an important construct in crisis-focused psychotherapy and may even constitute a mechanism of change in this specific intervention. Future studies should assess the mediating role of entrapment in crisis-focused psychotherapy in order to assess its potential role as a mechanism of change, while utilizing a study design which enables the determination of causality (Kazdin, 2007). For example, it can be hypothesized that the collaborative act of formulating and disentangling the essence of the crisis allows the patient to switch from a static mental position to a dynamic one, which then allows for the resolution of the crisis and movement toward more constructive solutions. Additional studies are needed to assess

potential mediating effects of specific interventions delivered in crisis intervention psychotherapy and their effect on entrapment, as well as the trajectories by which they affect the outcome. For example, it can be hypothesized that when crisis intervention psychotherapy is initiated, patients' levels of hope and confidence in their ability to recover from their distress are elevated. It can also be hypothesized that the working alliance mediates the influence of entrapment on therapy outcome (Dunster-Page et al., 2018), such that the mutual bond targeting the resolution of the crisis leads to symptom reduction. For example, it can be speculated that therapists working in the crisis intervention mode were able to deal with entrapment via the construction of a good therapeutic alliance despite the entrapment of the patients. Additional studies employing a larger sample size should assess such a potential mediating effect. The current study indicates that entrapment may serve as a psychological component that is relevant not only in cases of suicidal ideation, but also in situations of acute distress. Although entrapment has been previously found to be associated with several psychopathologies (Siddaway et al., 2015), no study has demonstrated its effect in patients presenting with acute distress. Clinically, the results of our study suggest that crisis intervention models might benefit from explicitly relating to the concept of entrapment, and from incorporating ongoing evaluations of this construct during psychological interventions. Such interventions can include an active assessment of feelings of entrapment as well as the construction of settings for the intervention to include the mutual search for alternative solutions.

This study has several limitations. First, due to the naturalistic nature of the study, as well as the nature of crisis events which frequently affect the ability to recruit patients, the sample size is considered small. Future studies should assess the effect of entrapment on crisis psychotherapy and regular care with a larger sample size. As there were significant differences in diagnoses across the study groups, with the crisis intervention group showing more adjustment disorders and the outpatient units showing more anxiety disorders, these differences may account for the differences in the effect of entrapment across the study groups. Although this confounder cannot be excluded, the differences between anxiety and adjustment disorder are not extreme, as they are often associated, and individuals with one or the other present similar clinical symptoms (Carta et al., 2009); therefore, the differences in diagnoses are not likely to account for our findings. Baseline differences between the study groups were also found in quality of life; thus, it is possible that these differences masked the ability to detect differential changes in this variable. Additional studies are needed in order to further assess the effect of crisis intervention on quality of life, compared to short-term psychotherapy. Finally, it is often argued that the concept of "crisis" lacks a specific operational definition. Thus, it can be postulated that the mere referral to psychiatric emergency does not necessarily constitute a crisis. Although this problem with the operational definition of crisis is common to most crisis intervention studies, future research should attempt to clarify the validity of this definition, as well as to assess the level of generalizability of our findings to other populations suffering from severe distress. Taken together, our study sheds light on entrapment as an important psychological factor involved in facilitating therapeutic change, and should therefore be incorporated in process psychotherapy research as well as in clinical practice.

DATA AVAILABILITY STATEMENT

The datasets generated for this study will be made available upon request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board of the Shalvata Mental Health Center. The patients/participants provided their verbal and written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

DT and AS initiated and designed the study, executed and acquired the data, and critically revised the manuscript. AO executed and acquired the data and drafted the manuscript. MS acquired the data and critically revised the manuscript.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 14 February 2020
doi: 10.3389/fpsyg.2020.00144

Love, Work, and Striving for the Self in Balance: Anaclitic and Introjective Patients' Experiences of Change in Psychoanalysis

Andrzej Werbart†, Annelie Bergstedt and Sonja Levander*

Department of Psychology, Faculty of Social Sciences, Stockholm University, Stockholm, Sweden

One of the most famous quotations credited to Freud is that, when asked what he thought a psychologically healthy person should be able to do, he said: "to love and to work." A central goal in psychoanalytic treatment is to bring about changes in basic, mostly unconscious, mental structures. The aim of this study was to investigate, applying an inductive thematic analysis, the experiences anaclitic and introjective patients have had of change after psychoanalysis with regard to the domains *Love and Relationships* and *Work and Achievements*. Analyzing patient interviews, we identified a third domain of experienced changes, *The Self*, which refers to increased self-understanding, self-acceptance, and self-care rather than an improved dynamic balance between love and work. All patients experienced several positive changes in their lives during and after psychoanalysis. We also found distinctive patterns that appear to be closely linked to the patients' initial personality orientation with regard to relationships and achievements. Generally, the patients described symmetrical, but opposite, change processes within the two specific domains of Love and Work. For the anaclitic patients, this indicated a movement inward in the domain of Love (from an excessive preoccupation with issues of their relationship with others toward more distinct self-boundaries and increased agency) and outward in the domain of Work (from unenterprising toward becoming more outgoing and daring). For the introjective patients, this pointed to a reverse movement outward in the domain of Love (from an excessive preoccupation with issues of autonomy toward increased responsiveness to others and desire to be establish close, mutual relationships) and inward in the domain of Work (from an excessive orientation on achievements toward increased becoming more grounded in their own feelings, needs, and desires). In conclusion, patients in both groups have experienced a reduced preoccupation with issues related to their initially predominant personality dimension (relatedness or self-definition) and increased receptivity to needs typical for the complementary dimension. These changes seem to be mediated by changes in the domain of *The Self*. Our study suggests the clinical relevance of focusing the therapeutic work on fostering a better and more dynamic balance between love and work, relatedness, or self-definition.

Keywords: psychoanalysis, patient perspective, dimensions of change, personality configurations, thematic analysis

OPEN ACCESS

Edited by:
Reitske Meganck,
Ghent University, Belgium

Reviewed by:
Kimberly Van Nieuwenhove,
Ghent University, Belgium
Benedicte Lowyck,
KU Leuven, Belgium

***Correspondence:**
Andrzej Werbart
andrzej.werbart@psychology.su.se;
andrzej@werbart.se

†***ORCID:***
Andrzej Werbart
orcid.org/0000-0003-0859-1012

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *12 September 2019*
Accepted: *20 January 2020*
Published: *14 February 2020*

Citation:
Werbart A, Bergstedt A and Levander S (2020) Love, Work, and Striving for the Self in Balance: Anaclitic and Introjective Patients' Experiences of Change in Psychoanalysis. Front. Psychol. 11:144. doi: 10.3389/fpsyg.2020.00144

INTRODUCTION

When Freud was once asked what he thought a psychologically healthy person should be able to do well, he was reported to answer: "lieben und arbeiten" (to love and to work). The phrase was quoted in 1950 by Erik Homburger Erikson (1963, p. 265) but cannot be found in Freud's writings (Elms, 2001). However, the maxim was not foreign to Freud (1961). For example, in *Civilization and its discontents* (1930/1961, p. 101), he stated: "The communal life of human being had. . . a twofold foundation: the compulsion to work. . . and the power of love. . ." The idea of a balance between love and work is also central to several influential theories of psychological maturity and well-being (e.g., Maslow, 1954; Rogers, 1961; Erikson, 1963). As suggested in 1980 by the grand old man of psychotherapy research, Hans Strupp (1980) the basic commitment of psychoanalysis is "to the dual goal of personal freedom and human relatedness" (p. 399). In a seminal paper, Hazan and Shaver (1990) linked secure attachment with the ability to find a balance between love and work.

According to Blatt's "double helix" model, psychological development is a lifelong synergic interaction between two fundamental dimensions in human experiences: relatedness and self-definition (Blatt, 2008; Blatt and Luyten, 2009; Luyten and Blatt, 2011). Following this model, psychological well-being involves both meaningful relationships with significant others as well as autonomy and differentiation between the self and others—in other words, a mature balance between affiliative and achievement-related needs. Most individuals, within a normal developmental variance, tend to emphasize one or the other dimension and differ in their relative emphases on issues concerning love and work. Different forms of psychopathology reflect an excessive and disturbed preoccupation with one dimension at the expense of the other. The anaclitic configuration is connected with difficulties in close relationships and attachment anxiety, while the introjective configuration is connected with excessive demands for achievement and perfectionism as well as attachment avoidance (Luyten and Blatt, 2013). Accordingly, anaclitic depression centers on feelings of loneliness, abandonment, and neglect, and introjective depression focuses on issues of self-worth and feelings of failure and guilt (Blatt, 1974, 2004; Blatt and Luyten, 2009).

Consistent results from several psychotherapy studies have indicated that anaclitic and introjective patients are differentially responsive to different aspects of the psychotherapy process and express therapeutic progress in different ways (Blatt, 1992, 2007, 2011; Blatt and Ford, 1994; Blatt and Shahar, 2004; Blatt et al., 2010; Luyten and Blatt, 2013; Lowyck et al., 2016). Anaclitic patients respond to the supportive dimensions of the treatment process, whereas introjective patients have a better therapeutic response to the exploratory-interpretative dimensions of the treatment process. Anaclitic patients change primarily in the quality of their interpersonal relations, whereas therapeutic change in introjective patients occurs primarily in the area of their manifest symptoms and in the level of cognitive functioning. Thus, both groups of patients display therapeutic change along dimensions congruent with their predominant personality organization.

In a quantitative multi-case study, Werbart and Forsström (2014) showed that both anaclitic and introjective patients in psychoanalysis maintained their characteristic personality style. However, all initially anaclitic patients and less than half of the initially introjective patients met the criterion of improved anaclitic–introjective balance post-treatment and/or follow-up. Noticeably, symptom reduction was accompanied by more mature integration of anaclitic and introjective personality dimensions in the anaclitic cases, whereas the introjective patients could show symptom reduction without improved anaclitic–introjective balance. Similarly, in a quantitative replication study of young adults in psychoanalytic psychotherapy (Werbart et al., 2017), the anaclitic patients showed better balance between relatedness and self-definition post-treatment, whereas this improvement was not significant in the introjective group. Still, on a descriptive level, both studies showed that the anaclitic as well as the introjective patients showed a mean score reduction on the predominant personality dimension and an increased mean score on the opposite dimension from pretreatment to termination. This indicates that psychoanalytically oriented treatments contribute to better anaclitic–introjective balance: decreased preoccupation with issues related to the predominant personality dimension and increased responsiveness to the issues characteristic for the complementary dimension.

Furthermore, qualitative studies demonstrated that the anaclitic and the introjective patients in psychoanalysis differ in their experiences of helpful and hindering factors in psychoanalysis and in their experiences of the analyst (Levander and Werbart, 2012; Werbart and Levander, 2016). The anaclitic patients talked of trust and a wish for support from their analyst, whereas the introjective patients wanted help with their control and in maintaining distance from others. The anaclitic patients could experience the firm time frames as a hindrance, whereas the introjective patients saw their own shortcomings but also the analysts' ways of working as the main hindrances (Levander and Werbart, 2012). In another sample, patients' pictures of their analysts after termination bore the stamp of the patients' predominant personality orientation. Anaclitic patients described both positive and negative aspects of their relationship, whereas introjective patients focused on both positive and negative aspects of the therapist as a separate individual (Werbart and Levander, 2016).

To sum up, previous studies open up for further questions. Is the therapeutic change in the anaclitic and introjective patients mainly congruent with their predominant personality orientation? What about the changes in the opposite dimension? Do the patients themselves experience better balance between relatedness and self-definition? Prompted by these issues, in the present study, we have focused on the anaclitic and the introjective patients' experienced changes in the areas of love and work. "Love and Relationships" refers here to the patients' coping with their affiliative needs and interpersonal bonds; and "Work and Achievements" refers to their coping with strivings for autonomy, performances, and self-demands. How

do the anaclitic and the introjective patients describe and value their changes after psychoanalysis in these two domains? What is distinguishing and what is common in their subjective experiences of change?

MATERIALS AND METHODS

Data Collection

The psychoanalyses included in the present study were conducted within the ordinary work of the former Institute of Psychotherapy, Stockholm County Council, Sweden, where subsidized psychotherapy was provided for people with various psychological problems. Consecutive cases of psychoanalyses were included during a 5-year period between 1997 and 2002. The 18 patients were referred to psychoanalysis from psychiatric outpatient clinics. The data were collected between 1997 and 2008 at intake, termination, and 2-year follow-up and included the following instruments: the Symptom Checklist-90-R (SCL-90; Derogatis, 1994), the Structural Analysis of Social Behavior (SASB) Intrex Questionnaire (Benjamin, 1987), and the Sense of Coherence (SOC) Scale (Antonovsky, 1987). The data were previously used in two studies of changes in anaclitic–introjective personality dimensions following psychoanalysis (Werbart and Forsström, 2014; Werbart and Levander, 2016). The present study is based on 14 patient interviews at termination and 12 patient interviews at 2-year follow-up (26 patient interviews in total). At follow-up, one former patient was unreachable and another one was deceased after prolonged illness (one of the cases was assessed as initially anaclitic and the other as introjective). Additionally, 14 analyst interviews at termination were included in the assessments of the patients' initial personality configurations.

Participants

The attrition was 22%: three patients declined participation in the data collection and one patient started low-frequent psychotherapy instead of psychoanalysis (defined as a treatment conducted by a psychoanalyst with a frequency of four to five times a week). Thus, the sample comprised 14 cases of psychoanalysis. The mean age of the patients at inclusion was 33 years (range 25–46; *SD* 7.1), and 12 of them were women. All patients but one had received previous psychiatric treatment; 12 patients had also prior experience of psychotherapy. The patients' psychiatric diagnoses were not accessible to us. However, their most common presenting problems were depression and anxiety; anorexia, psychosomatic symptoms, self-harm, and protracted crisis reactions were also represented. Four patients were on psychopharmacological medication at the start of psychoanalysis; two of them continued medication at both termination and 2-year follow-up, while a further two resumed medication at follow-up.

The 14 included analyses lasted for between 46 and 85 months (M = 61; SD 14.7) with a frequency of four sessions a week and were conducted by eight highly experienced female analysts. On the group level, the patients improved on all measures, with effect sizes comparable to mean effect sizes reported in a meta-analysis of studies regarding the effectiveness of psychoanalytic treatments (de Maat et al., 2013), and the improvements continued after termination. Most patients showed positive outcomes in terms of symptom reduction (SCL-90) and improved quality of life (SOC), and the proportion of patients showing clinically significant change was comparable to data presented by de Maat et al. (2013), while changes in positive and negative self-concept (SASB) were more limited. For more detailed outcome data, see Werbart and Forsström (2014) and Werbart and Levander (2016).

Change After Psychotherapy Interviews

The applied CHAP-protocol (Change after Psychotherapy; Sandell, 2005, 2015; Sandell and Wilczek, 2016) is especially designed to capture the complexity patients' subjective experiences of change during and after psychotherapy. The patients are asked about in what ways they have changed during or after the therapy, how they feel now and how their present life situation is in comparison with their pre-treatment life, what has improved, what is unchanged or worse, and what contributed to these outcomes. The analysts were asked corresponding questions about their patients.

Assessment of Personality Configuration

Assessment of the patients' initial personality configurations followed the procedure of *Prototype Matching of Anaclitic-Introjective Personality Configuration* (PMAI; Werbart and Forsström, 2014; Werbart and Levander, 2016). On the basis of CHAP interviews, two raters assessed the extent to which the presentations of the patient's problems and life circumstances pre-treatment matched prototype descriptions of the anaclitic and introjective personality orientation. Due to the research design, the initial personality configuration was assessed based on the CHAP descriptions of the pre-treatment situation. To enhance the validity of these ratings, both patient and analyst CHAP interviews at termination were used in each case. The raters, two students at an advanced psychotherapy training program, were trained in the PMAI assessment. The inter-rater reliability was satisfactory (ICC = 0.65). Cases were assessed as initially anaclitic or introjective based on consensus ratings and following the highest pre-treatment score on one of the two dimensions. This resulted in seven patients classified as initially predominately anaclitic and the remaining seven patients as predominately introjective (Werbart and Forsström, 2014; Werbart and Levander, 2016).

Comparative Thematic Analysis

A first step in the data analysis was to select all utterances about experienced changes from the CHAP interviews. The patients' descriptions of changes were categorized using an inductive thematic analysis (Boyatzis, 1998; Braun and Clarke, 2006), a method also called "inductive clustering" (Miles and Huberman, 1994). At an early stage of data analysis, it turned out that the described changes displayed only negligible differences between the interviews at termination and at the 2-year follow-up. This means that the same themes emerged at both occasions, even if the degree of elaboration could vary. Accordingly, the

categorization was performed, combining both interviews for each case (in the two cases of attrition at follow-up only the interviews at termination could be used). Following the aims of the present study, the patients' experiences of changes were analyzed separately in the thematic domains *Love and Relationships* and *Work and Achievement*. A new thematic domain emerged in the analysis process: *The Self*, comprising themes of experienced change outside the dichotomy of Love and Work. An illustration of the data-driven coding process is provided in **Figure 1**.

The categorization of experienced changes was performed blindly for the patients' personality configuration. The total interview material was analyzed jointly by two judges (the second author and another student of psychology), following the rules for consensual qualitative research (Hill et al., 2005), and audited by the first author. The step-by-step procedure of thematic analysis (Braun and Clarke, 2006) started with close reading of the 26 interview transcripts, searching for meanings and patterns in the descriptions of experienced changes. In the next step, relevant segments of transcripts were identified and the two judges generated initial codes. Subsequently, the similar or closely related codes were assembled into core themes (categories of experienced changes) and labeled. The themes were repeatedly revised, compared to the data, and refined in consensus discussions. In the process of elaborating descriptions of each category and sorting the categories into the two predetermined domains, the new thematic domain of *The Self* was formed.

After the list of core themes was established, the data were decoded, and the anaclitic and the introjective patients' experiences of changes were compared. Results within each domain were organized in descending frequency of cases in each domain. Frequencies are reported separately for the anaclitic and introjective group as well as for the total sample, following nomenclature from Hill et al. (2005). The label "general" applies to all, or all but one case, "typical" to more than half of the patients, and "variant" to at least two and up to half of patients. Due to the small numbers, a difference of two or more cases together with different labels was considered as a between-group difference (cf., Werbart and Levander, 2016).

RESULTS

Thematic analysis of the patients' narratives of change resulted in 12 categories (core themes) within the domains *Love and Relationships* and *Work and Achievements*. However, in analyzing patient interviews, four additional themes emerged, and together they constitute a third domain, *The Self*, which refers to changes that are directed toward the individual's experience of being a particular person and a subject of own reflexive consciousness rather than changes in the dynamic balance between love and work. The categories of experienced change are reported for the initially anaclitic and introjective patients and for the total sample in **Table 1** and presented below. The change categories are illustrated below by verbatim quotations from interviews with patients from both groups. All patients have been given assumed names with the initial letters "A" for the anaclitic and "I" for the introjective patients. Quotations from interviews both at termination and follow-up are included. The presentation of each domain concludes with a between-group comparison.

1. Love and Relationships

1.1. Increased Relational Insight Fostering New Ways of Relating

As a variant, anaclitic patients and, typically, introjective patients described how an increased reflective self-examination of own relational patterns across different social contexts guided them to more adaptive ways of relating to others. New interpersonal awareness and self-observing ability helped them to recognize problematic patterns and to relate to others in more mindful and constructive ways. For example, they could gain a more profound understanding of how own fears of rejection and negative assumptions previously had influenced them to "act blindly" or "do the opposite." Women could feel being attracted to different kinds of men than before, the anaclitic patients no longer seeking unconditional love and the introjective patients no longer being tempted by men who hurt them. Patients in both groups experienced an improved capacity to deepen existing relationships and to build new ones.

1.2. Increased Trust in Others, Relational Self-Confidence, and Openness

Typically, anaclitic patients and, as a variant, introjective patients described how processing previous traumas and suffering offered an opportunity to build up an inner security in interactions with others. They told about feeling less alienated, challenging old beliefs about themselves in relationships, and daring to long for contact with others. They described developing a more solid self-confidence and being less governed by fear and shame, which enabled them to be more open and receptive toward others and to experience the joy of having others in their lives. They experienced growing reliance on others' ability to meet their needs and on their own ability to seek help and share difficulties.

1.3. Improved Ability to Deal With Difficulties and Conflicts in Close Relationships

Typically, anaclitic patients and, as a variant, introjective patients described how psychoanalysis helped them to recognize different viewpoints in situations, adjust high expectations of significant others, and question their ways of interacting with others. Exploring patterns of interpersonal difficulties gave them a greater relational self-awareness and an increased tolerance for conflicts. They learned more constructive ways of dealing with disagreements and negative emotion. Furthermore, they developed a greater ability to become reconciled with their past relational patterns, accept circumstances they could not change, and to have more fun with people around them.

1.4. Increased Ability to Set Limits and Take Responsibility for Oneself

As a variant, patients in both groups described taking a more active part in how their relationships develop. This included being better at seeing their own role, having less feelings of

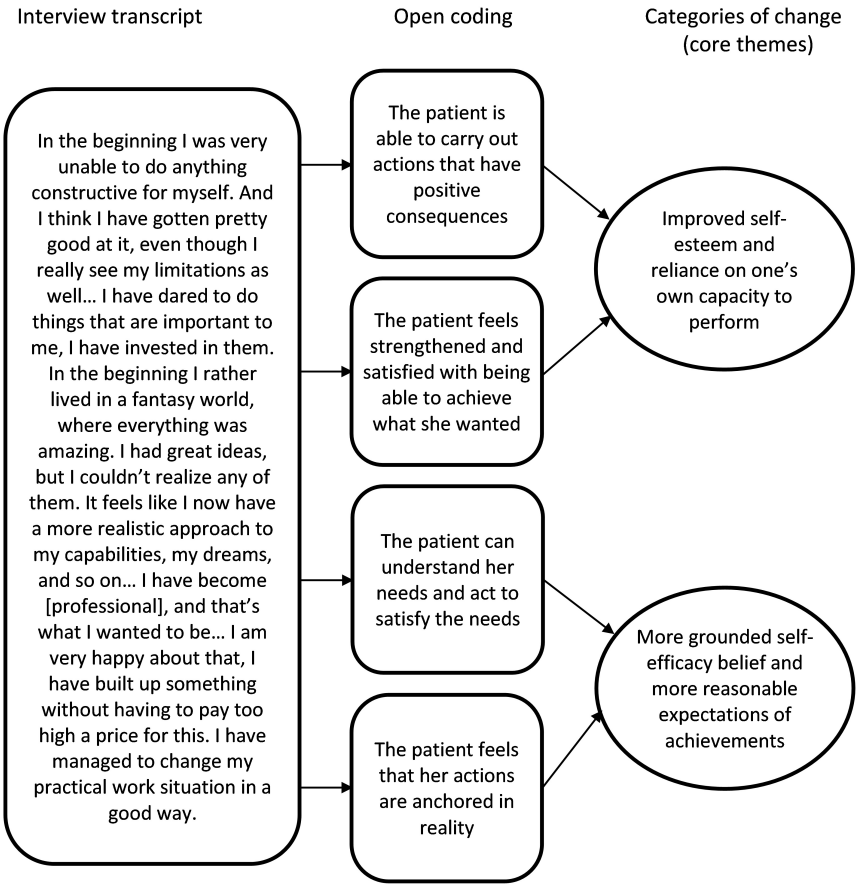

FIGURE 1 | Data analysis: steps from interview transcripts to categories of change (core themes).

victimhood, and assuming more responsibility in relationships. Patients also came to act in more self-regarding ways, recognizing their own needs and boundaries as legitimate sources of action. Patients described changes such as becoming less reactive and more in control of things. They gained courage to stand up for themselves, to recognize their own determination and power to affect their relationships, and, in that way, to take better care of themselves in relationships.

1.5. Increased Capacity for Intimacy and More Authentic and Meaningful Relationships

As a variant, patients in both groups described an increased openness for own affiliative needs, daring to feel and express love and vulnerability as well as to disclose themselves and confide in others. They felt they developed an ability to handle closeness and to deepen their relationships based on intimacy and reciprocity. Furthermore, they became more susceptible to the needs of others and more accessible to their friends, parents, or partners.

1.6. More Stable Self-Boundaries and Increased Independence in Relationships

Anaclitic patients typically described how they developed more pronounced and stable self-boundaries. What led them to psychoanalysis was lacking a sense of inner kernel, being excessively preoccupied with mirroring themselves in others, seeking approval, and having an infantile need of being taken care of by their partners. Becoming more in touch with their emotions and increasing their self-knowledge enabled them to be more grounded in themselves. Patients described how gaining a better sense of own identity and independence fostered new ways of being with others. This theme was absent in the narratives of introjective patients.

1.7. Improved Ability to Express Own Feelings, Needs, and Wishes in Relation to Others

As a variant, patients in both groups described a new awareness of previously suppressed emotions. They felt that it was more okay to be afraid or angry and learned to recognize what they felt and needed in relation to others, to react, let go of emotions, and to speak up instead of "becoming paralyzed" or to "stash away feelings." This seems to have made them more able to show who they were without subsequent feelings of guilt or anguish and to dare to be honest with themselves and with others.

Comparison

Although both anaclitic and introjective patients described several similar positive changes within the domain *Love and Relationships*, we also found distinguishing patterns, closely

linked to their initial personality orientation and the problems that brought them to analysis. Both anaclitic and introjective patients expressed an increased insight in own relational patterns and a new ability to challenge their perceptions of themselves and others. They felt they developed more adaptive ways of dealing with social situations, regulating closeness and distance, and assuming greater responsibility for themselves. Central to these processes was an increased trust and being more in contact with and accepting of their own feelings and affiliative needs. Nevertheless, we found four between-group differences in frequencies of categories within this domain (**Table 1**). More anaclitic than introjective patients reported increased trust in others and relational self-confidence, improved ability to deal with relational difficulties and conflicts, and more stable self-boundaries and increased independence. More introjective than anaclitic patients reported increased relational insight and new ways of relating.

Most importantly, not only the predominantly anaclitic patients but also the predominantly introjective patients described essential improvements in the domain *Love and Relationships.* However, there are some qualitative distinctions between the two groups as to the content and direction of these changes. The anaclitic patients described that, prior to analysis, they felt a lack of a stable identity and an inability to sort out and regulate their emotional reactions. They gave several examples of a development from an excessive preoccupation with how other people perceived them and what others had exposed them to and a great need of being approved, liked, and cared for by others, toward a greater recognition of their own behavior and the roles they tended to take in relationships. This indicated an overall movement *inward*, from an excessive neediness and preoccupation with others toward an increased interpersonal self-awareness, more distinct self-boundaries, increased agency, and emotional balance.

> *When I started in psychoanalysis, everything tended to be about my family and what other people had done to me. Some sort of huge disappointment. From that, it became much more about myself, going into myself and back to myself, what I was doing to myself, it was a very important progress. [. . .] That was very difficult to discover, and it took a long time to deal with. [Amanda, termination]*

> *[. . .] I am not so keen to "win" other people's favor any longer. [. . .] I think I dare to put my foot down more often now. Even if it's not a major revolution, it makes me proud. [. . .] Things seem to get less charged. When I don't need to be in control in the same way, then it becomes less awkward to others if I speak up. If I want to draw a limit, then I do. That doesn't mean I reject them for the rest of my life. Only "not here, and not now, I say no." So I have changed. [Andrew, follow-up]*

In contrast, the introjective patients' descriptions of change focused on themes of control and independence. They described their avoidant or dismissive relational patterns prior to psychoanalysis due to their fears of rejection, feelings of inferiority and shame, and a profound inner sense of not deserving love and care. Inability to cope with intimacy and closeness resulted in loneliness, isolation, or relationships marked by emotional unavailability and lack of reciprocity.

TABLE 1 | Categories of experienced changes among anaclitic and introjective patients in psychoanalysis.

Category	Anaclitic		Introjective		Total	
	(*n* = 7)	Label	(*n* = 7)	Label	(*n* = 14)	Label
Domain 1: Love and Relationships						
1.1. Increased Relational Insight Fostering New Ways of Relating	**3**	**Variant**	**5**	**Typical**	8	Typical
1.2. Increased Trust in Others, Relational Self-Confidence, and Openness	**4**	**Typical**	**2**	**Variant**	6	Variant
1.3. Improved Ability to Deal With Difficulties and Conflicts in Close Relationships	**4**	**Typical**	**2**	**Variant**	6	Variant
1.4. Increased Ability to Set Limits and Take Responsibility for Oneself	3	Variant	3	Variant	6	Variant
1.5. Increased Capacity for Intimacy and More Authentic and Meaningful Relationships	2	Variant	3	Variant	5	Variant
1.6. More Stable Self-Boundaries and Increased Independence in Relationships	**5**	**Typical**	**0**	**Absent**	5	Variant
1.7. Improved Ability to Express Own Feelings, Needs, and Wishes in Relation to Others	2	Variant	2	Variant	4	Variant
Domain 2: Work and Achievements						
2.1. Improved Self-Esteem and Reliance on One's Own Capacity to Perform	**5**	**Typical**	**3**	**Variant**	8	Typical
2.2. More Grounded Self-Efficacy Belief and More Reasonable Expectations of Achievements	**2**	**Variant**	**5**	**Typical**	7	Variant
2.3. Increased Insight Into Achievement Related Patterns of Behavior	3	Variant	2	Variant	5	Variant
2.4. More Flexible Coping and Adjustment to Performance-Related Stress	**1**	**Rare**	**4**	**Typical**	5	Variant
2.5. Better Contact With Own Achievement-Related Needs and Increased Self-Determination	**0**	**Absent**	**3**	**Variant**	3	Variant
Domain 3: The Self						
3.1. More Mature and Nuanced Self-Understanding and Realistic View of Life	6	General	5	Typical	11	Typical
3.2. Enhanced Self-Regard and Ability to Care for Oneself	4	Typical	4	Typical	8	Typical
3.3. Increased Ability to Accept and Value Oneself	4	Typical	3	Variant	7	Variant
3.4. Improved Reflective Capacity, Experiential Processing and Resilience	4	Typical	3	Variant	7	Variant

Note. Frequencies of cases in each category (labeled following Hill et al., 2005) separately for the anaclitic and introjective group (General: six to seven cases; Typical: four to five cases; Variant: two to three cases; Rare: one case) and totally (General: 13–14 cases; Typical: 8–12 cases; Variant: two to seven cases; Rare: one case). Between-group differences of two or more cases and different labels are in bold (cf., Werbart and Levander, 2016).

In psychoanalysis, they felt they gained an increased awareness of own avoidant patterns, became less governed by fears of being dependent or losing control, and were better able to handle intimacy and interdependency. They became capable of asking others for help and support, to care for their close relationships, and to be more present as parents, partners, and friends. Taken together, this indicated a movement *outward* from an excessive preoccupation with self-boundaries and autonomy toward greater acceptance of own affiliative needs, increased ability and desire to establish and deepen close, mutual relationships, and increasing responsiveness to others.

> *I started psychoanalysis and came to question my pattern with men. [. . .] I had dated married men; I had lived with men who hurt me. And now, I have met a man who is incredibly caring and loving, he is completely different. This would never have attracted me before; it would have been boring and not so appealing. Anyway, it is an incredible change; I am fully convinced that I would never have met him if it wasn't for psychoanalysis. It's simply an incredible difference, this closeness, and to bear him actually seeing how sick I am, and to feel that it is okay, it was unthinkable before. [Irja, termination]*

> *I didn't want to say a word about myself to another person! [. . .] The most difficult thing was that when something happened, when I ever needed to talk to someone, I couldn't do it. When I tried, it made me feel even worse. I felt really bad about what I had told and how it could be perceived by others. Now, I can do this very well, I am able to open up and to talk about it, it's virtually no problem at all. [. . .] And the most amazing thing, I also thought, what a lot of amazing people out there, they didn't exist before. And it is hardly because the people have changed, but only that I see them. [Inez, follow-up]*

2. Work and Achievements

2.1. Improved Self-Esteem and Reliance on One's Own Capacity to Perform

This theme, typical for anaclitic and a variant for introjective patients, embodies descriptions of how psychoanalysis contributed to greater professional confidence. Patients described how they came to nuance their self-perception, challenging old convictions of their professional self and what they could attain in life. The felt they started daring to believe in themselves, discovered new options, and succeeded to make concrete changes in their lives, such as returning to work, finishing their studies, changing occupation, or setting up their own business. New perspectives on themselves and recognition of both capabilities and limitations made them feel liberated, more positive, and confident in possibilities to form their own future.

2.2. More Grounded Self-Efficacy Belief and More Reasonable Expectations of Achievements

As a variant, anaclitic patients and typically, introjective patients described how previous excessive self-demands, need of control, and pursuit of performance turned into obstacles to personal development and growth and impaired their quality of life. In psychoanalysis, unrealistic expectations had been shut down and many illusions been abandoned. Patients described how they reappraised their ambitions and direction in life, becoming at peace with themselves. Being less hard on themselves, and able to set more realistic goals, patients could both manage to accomplish ambitions and find more pleasure in life.

2.3. Increased Insight Into Achievement-Related Patterns of Behavior

As a variant, patients in both groups described gaining insight in own performance-related patterns of behavior, as well as an increased capacity to reflect on and to place their aspirations and difficulties in a context of their personal history. This helped them to establish a basis for professional initiative and determination, to prioritize differently, to widen their perceived scope of opportunities and to feel more as participants in their own lives.

2.4. More Flexible Coping and Adjustment to Performance-Related Stress

The introjective patients typically described how they learned to moderate their need for control and how they became kinder and more generous to themselves, less governed by rigid self-demands and feelings of shame. They felt that they could cope better with strains and difficulties and develop more adaptive strategies to meet performance-related challenges. They learned to ask for help and to use people around them for support. The only anaclitic patient in this theme described that she became less sensitive, no longer avoided challenges, and was better at accepting shortcomings.

2.5. Better Contact With Own Achievement-Related Needs and Increased Self-Determination

Only introjective patients described, as a variant, better contact with own work-related aspirations and needs, feeling less of a need to be at the center of attention, and becoming less directed by experienced expectations of others. They felt better anchored in themselves, with a greater sense of autonomy and self-assertiveness.

Comparison

Many of the changes, described in a similar way by both anaclitic and introjective patients, implied concrete and significant shifts in their lives. They could return to work, change occupation, apply for studies, or accomplish their education. Patients described improved professional confidence, having more realistic and nuanced expectations of achievements, recognizing capabilities as well as limitations, and obtaining tools to manage hardships and challenges in new, more constructive ways. In this domain, we also found four between-group differences (**Table 1**). More anaclitic patients described improved self-esteem and reliance on one's own capacity to perform, whereas more introjective than anaclitic patients described a more grounded self-efficacy belief and expectations of achievements, better coping with performance-related stress, and better contact with own achievement-related needs.

Accordingly, not only the predominantly introjective, but also the predominantly anaclitic patients experienced crucial changes in the domain of *Work and Achievements*. However, the nature of

their initial difficulties and the direction of these changes differed. Among anaclitic patients, fantasies and unrealistic expectations of achievements appeared to have contributed to psychological barriers leading to apathy, dejection, and lack of action. In psychoanalysis, they were able to strengthen their self-confidence and change perspective on their professional selves and what they could attain in life. Adjusting their goals and ambitions to be more realistic helped them to break passivity and not be as hindered by anxiety and fear of failure as before. The anaclitic patients described becoming more outgoing, courageous, and daring in their enterprises. Accordingly, their accounts of changes within the domain of *Work and Achievements* implied an overall expansive turn *outward* from states of passivity and hiding themselves toward daring to believe in themselves, be ready to face the world, and to take action.

I think I had an illusory picture of myself and what I had to achieve. That was why I didn't manage to go out and perform. It always felt like a failure, because I had a preposterous picture of who I was. [. . .] My expectations of every job were so high, so in the end I didn't look for a job anymore. [. . .] But at the end of psychoanalysis, I began to increasingly see myself in a more realistic way. I think I did it quite concretely. [. . .] [My analyst] helped me achieve smaller goals, to cope with things. [Astrid, termination]

I have dared to do things that are important to me, I have invested in them. In the beginning, I rather lived in a fantasy world where everything was amazing. I had great ideas, but I couldn't realize any of them. It feels like I now have a more realistic approach to my capabilities, my dreams, and so on. [. . .] I have become [professional], and that's what I wanted to be [. . .] I am very happy about that, I have built up something without having to pay too high a price for this. I have managed to change my practical work situation in a good way. [Amanda, follow-up]

Introjective patients described that what brought them to psychoanalysis were excessive self-demands, perfectionism, and need of control. They felt that their rigidity, self-criticism, and striving for achievement and recognition resulted in high workloads, restless activity, performance-related anxiety, high internal stress, and an urge to constantly challenge themselves. In psychoanalysis, they came to realize how unreasonable expectations and their constant need of pushing themselves affected their quality of life. They described their changes in terms of wishing for a better life, learning to moderate their demands, reevaluating ambitions, gaining more flexible control over their lives, achieving greater calm, as well as living more slowly, thoughtfully, and in greater contact with their own needs and aspirations. Taken together, this resulted in increased stability and self-determination. The changes described by the introjective patients within this domain can be summarized as a turn *inward*, from an excessive orientation on achievements and prestige toward increased introspection and reflection, becoming more grounded in their own feelings, needs, and desires.

Yes, the turning point is my job. When I got the job I have today, it was extremely important. At the same time, I think psychoanalysis enabled me to take this job. That I could trust myself to the extent that I dared to act. [. . .] [A]fter all, it is a very good incentive for yourself when you can handle things in life. Thus, psychoanalysis has led me to re-evaluate a little, not only myself, but also my ambitions, my visions, what I want with things. It has been useful, I think. [. . .] I have had very high demands on myself throughout my life [. . .] I had to be very good at everything. [. . .] Today I do not have quite as rigid demands on myself as before. [Ingvar, termination]

Some kind of urge, but whose urge was it really? [. . .] Before, my life consisted in constantly being challenged. I have grown up with this. [. . .] I had a lot of public roles, so to speak. I lectured a lot and I taught a lot. At parties I sang, it was very much me in the limelight. [. . .] What I have now is what has been left when the other things disappeared. [. . .] I couldn't endure to live up to that. [. . .] Nowadays, I have no need to attract attention. I take it very cautiously; I don't want to have any expectations on me. I have no need to please anyone either, and that's pretty nice. [Ingrid, follow-up]

3. The Self

3.1. More Mature and Nuanced Self-Understanding and Realistic View of Life

Generally, the anaclitic patients, and, typically, the introjective patients, described changes that indicated more mature and complex views of themselves and of life. In psychoanalysis, they learned to problematize and nuance their immediate perceptions and to have an inner dialogue. This contributed to a more solid ground to stand on, a more realistic and down-to-earth view of life, making them more ready to meet new strains in life. They felt that they no longer deceived themselves and hid behind a mask, becoming more genuine in their feelings and expressions, but they were also being forced to live more like a "sober alcoholic" and "endure the lack of excitation" [Ingrid, termination]. Gaining a deeper self-understanding helped them to view themselves with greater sympathy and to live in a more conscious, balanced, responsible, and independent way.

3.2. Enhanced Self-Regard and Ability to Attend and Care for Oneself

Typically, patients in both groups expressed how they got more insight in their own self-destructive patterns of behavior and self-punishing or careless habits. In psychoanalysis, they gained a new desire to care for their health and well-being, becoming better at "mothering themselves" and at assuming responsibility for their own welfare.

3.3. Increased Ability to Accept and Value Oneself

Typically, anaclitic patients, and, as a variant, introjective patients, described how they could more easily admit to themselves and reconcile themselves with different aspects of their personality. They could start psychoanalysis with a desire to "become a new person" [Irma, termination] but instead learned to deepen their self-understanding, to accept their negative traits, to be less self-critical, and no longer be haunted by shame and guilt. They described increased self-esteem and a better ability to value themselves as they were, despite flaws and shortcomings. They felt more mature and genuine, less helpless, stronger, and more generous.

3.4. Improved Reflective Capacity, Experiential Processing, and Resilience

Typically, anaclitic patients, and as a variant introjective patients, described an improved capacity to reflect upon themselves. They felt they were more thoughtful, more able to sort out different qualities in their reactions, to harbor emotions, to make inner and outer events less abstract and more comprehensible, and to meet difficulties one at the time, not rushing into action. They experienced themselves as more stable, resilient, ready to reconcile with the past, and to manage the unpredictability of the future.

Comparison

Unlike the domains of Love and Work, we found no distinctive patterns for the anaclitic and the introjective patients within the domain of *The Self*. Accordingly, we found no between-group differences in the frequencies of categories (**Table 1**). Instead, patients in both groups described similar experiences of gaining more mature and nuanced perspectives on themselves and of life, being able to live a more balanced life, taking better care of themselves, and assuming responsibility for their own well-being. Abandoning illusions and hopes of "becoming a new person," patients generally learned to accept and value themselves as they were, became reconciled with the past and with different aspects of their personality, able to give vent to their experiences and sorrows, to sort out and harbor emotions, and to reflect on themselves. This made them more anchored in themselves, stronger and more stable, resilient and responsible, happier and more able to appreciate the good life, and confident in their ability to manage future challenges.

> *Today, I try to encounter difficulties one at a time. I feel more at peace with what has been and how it is now, and then I can face new problems or opportunities in another way, I have some sort of faith that I can cope with this at least. I couldn't do this before. [. . .] Nowadays, I rather try to view things from different perspectives, testing different ways to look at it. To feel "how does it feel?" and then let it rest in me. I feel I can harbor things in a different way; I don't need to ward off or try to mitigate it at once. I think I'm more balanced, feeling harmonious in a way that makes me capable. [Angelica, termination]*

> *I have gained a greater ability to have a dialog with myself, and to parry situations, so to say. And then, when I can identify or discern why I'm sad and clarify it to myself, I'm able to let it be so. I regard this as the most important thing, to allow and accept things as they are, and then try to do the best out of things, I try to do the best possible for myself in that particular situation. So this is a strong capability. [Irma, follow-up]*

DISCUSSION

The present study aimed to investigate the initially anaclitic and the initially introjective patients' experienced changes in the areas of love and work. Both the anaclitic and the introjective patients experienced changes in both areas and typically described less issues related to their predominant personality configuration. However, one of the main findings in our study was the symmetrical, but opposite, pattern of changes in the two patient groups. For the anaclitic patients, changes in the domain *Love and Relationship* involved *turning inward*, from an excessive dependency and preoccupation with others toward an increased self-awareness, independence, relational self-confidence, and more stable and distinct self-identity. In contrast, their descriptions of changes in the domain of *Work and Achievements* indicated an expansive turn *outward*, from passivity, resignation, and low self-esteem toward becoming more outgoing, self-confident, and daring in their professional or educational undertakings. For the introjective patients, changes in the domain *Love and Relationships* implied turning *outward*, from an excessive preoccupation with self-boundaries, independence, and relational distance toward an increased acceptance of own affiliative needs and responsiveness to others, being more able to establish and deepen meaningful close relationships. In the domain *Work and Achievements*, on the other hand, their descriptions implied turning *inward*, from unrealistic self-standards, excessive striving for achievements and craving for recognition toward increased self-reflection, inner calm, more realistic self-demands, and a more thoughtful, balanced, and slow living. Looking at the quality of the experienced changes, both patient groups seem to describe a decreased preoccupation with issues related to their predominant personality dimension and an increased responsiveness to needs typical of the neglected dimension, and thus they were able to integrate features pertaining to the complementary polarity.

Comparing the anaclitic and the introjective patients' experiences of change, we found no differences in frequencies of categories with the domain of *The Self*. However, we found four such differences in the domain of *Love and Relationships* and a further four in the domain of *Work and Achievements*. This is consistent with findings from previous quantitative studies (Werbart and Forsström, 2014; Werbart et al., 2017), showing an improved anaclitic–introjective balance in both patient groups after psychoanalytical treatments. Both groups of patients described changes in the domains of Love and Work in directions complementary to their initial personality orientation. In this process, changes in the area of the Self seemed to function as mediators of changes in the areas of Love and Work. For the anaclitic patients, several of the changes within the domain of *The Self*, such as a more nuanced self-understanding, an improved reflective capacity, and experiential processing, might have contributed to their increased emotional stability, ability to deal with difficulties in relationships, and increased self-confidence and self-determination. For the introjective patients, changes within the domain of *The Self*, such as a more mature and realistic self-understanding, improved cognitive capability, and increased self-acceptance, might have contributed to the increased openness toward own affiliative needs, decreased performance-related anxiety, and more adequate need of control.

Our findings indicated the centrality of the area of the Self in the change process. This is consistent with previous studies, suggesting that changes in self-representations precede

changes in representations of significant others, and that these changes can predict therapeutic change in terms of psychosocial functioning (Harpaz-Rotem and Blatt, 2005; Blatt et al., 2008). Accordingly, qualitative studies of patients' experiences of psychotherapy demonstrated the critical role of the therapists' ability to foster changes in the area of the Self (Elliott and James, 1989; Klein and Elliott, 2006; Levitt et al., 2016; Werbart et al., 2016). However, this does not imply that changes within this area can be regarded as being isolated from changes in the domains of Love and Work. For example, a study on patients' experiences of change after dynamic interpersonal therapy found that patients appeared to have become more aware and accepting of their own desires and needs and better at caring for themselves (Leonidaki et al., 2016). This indicated improved reflective capacity and ability to mentalize their own and others' mind.

No new category of change emerged from the follow-up interviews, even if some aspects of change could be more elaborated. For example, becoming more reconciled with one's history and experiencing a consolidation of insights and both inner and outer changes were often more pronounced at the follow-up. In both groups, the former patients described that they continued to benefit from the time in psychoanalysis and that their changes continued after termination, even if some problems remained. They could describe how psychoanalysis became a part of their inner world:

> *[. . .][S]omehow, it all feels more integrated into me. The analysis exists and lives within me. [. . .] [My analyst] and I talked a lot about getting this therapist function within me, that this was the aim: to be able to reason with myself, to have this inner dialog. [. . .] So, I feel this is a part of me; my analysis is a part of my frame of reference and my personality as well. [Angelica, follow-up]*

However, positive developments might imply loss and mourning. At follow-up, three patients expressed ambivalence toward their inner and outer changes, experiencing loss of previous ways of being, beyond the point of no return. Anja described that she had to pay a price for becoming more independent and emotionally balanced: "in this destructiveness there was something that was more alive. [. . .] [I]t is hard not being able to feel as wounded [. . .] I am hardened." Ingrid felt that her life after psychoanalysis became "flattened and boring," lacking "drive and excitation," even if she thought "it was false" and valued "not burning herself at all ends." Inez felt she was no longer "as perfect, faithful, consistent, and dutiful" as before, experiencing this as "a loss of whole my identity." However, she appreciated changes and thought that her problem was that "everything was so impotent and had to be so perfect." For the anaclitic patient, the price for positive changes was loss of emotional excitement, whereas the two introjective patients experienced loss of their high ideals and the struggle for perfectionism. Even if the patients described loss and mourning of previous ways of being, they could problematize the meaning of these feelings and consider the changes worth their price.

Previous research has indicated that patients primarily undergo changes *congruent* with the dominant polarity of their personality configuration (Luyten and Blatt, 2013; Werbart and Forsström, 2014). Anaclitic patients appear to primarily improve the quality of their interpersonal relationships, whereas introjective patients primarily show improvements in cognitive ability and reduced clinical symptoms (Blatt and Ford, 1994). Accordingly, in our study, the anaclitic patients described improvements in the area of intimacy and interpersonal relatedness, whereas the introjective patients described more reasonable striving for achievements and autonomy. Features typical to their respective personality styles emerged with relative clarity in the ways in which they tended to express themselves and what they focused on in their descriptions of change. Anaclitic patients leant to describe their previous difficulties and their changes in more passive, reactive terms, focusing on affective aspects. In contrast, introjective patients used more factual terms and described changes in a reasoning way, focusing on concrete actions and behaviors. For example, reduced need of approval from others meant for anaclitic patients feeling more independent and less in need of being confirmed by others to maintain an inner stability and a sense of who they were as persons. For introjective patients, it was a matter of more realistic expectations of achievements and increased ability to be happy and satisfied with themselves. Whereas anaclitic patients tended to describe a more stable and firm control, introjective patients described reduced rigidity and more flexible control. These different patterns of verbal communication are consistent with a previous study showing that anaclitic patients use verbalizations indicating a desire for emotional empathy and support, whereas introjective patients tend to communicate in a more distanced and emotionally controlled way and use verbalizations that facilitate exploration and reinterpretation (Valdés and Krause, 2015).

In the present study, vital to the patients' experiences were changes in the opposite, *complementary* dimension, turning in the opposite directions in the areas of Love and Work. Thus, our study confirms Blatt's (2007) and Blatt and Luyten's (2009) expectation that the therapeutic process can enable patients to become more open to needs typical for the other polarity. Whereas the congruency hypothesis is supported by both quantitative studies (perspective from the outside) and by patients' subjective experiences, the complementarity of change is supported by applying perspective from within the patients' experiences, as explored in qualitative studies. It seems that psychoanalysis helped the patients to no longer be stuck or overwhelmed by issues that are predominantly manifested in one domain, either Love or Work, opening for the dimensions of Love and Work to interact more dynamically.

In each individual case, we encountered unique, idiosyncratic links between changes within the three domains. Nevertheless, our results suggested that changes in the area of the Self were associated with finding more adaptive ways of being with others, more adaptive coping with strains in life, gaining an increased self-confidence, both socially and professionally, and improved capacity

to tolerate and deal with affiliative and achievement-related needs, as well as with difficulties in these areas. The domain of the Self, as experienced by the patients in the present study, seems to be an area of integration of the two developmental lines, relatedness and self-definition, in the maturational process, as described by Blatt (2008). Furthermore, narratives of both the anaclitic and the introjective patients indicated that they experienced their changes as a developmental process. According to Blatt's two-polarities model, therapeutic progress results from reactivation of normal psychological developmental processes and new internalizations. Within the therapeutic relationship, old petrified patterns can be challenged, reviving the dialectical synergic interaction between the two fundamental polarities of relatedness and self-definition (Blatt et al., 2008; Luyten and Blatt, 2013). According to Blatt, this involves alternating sequences of *gratifying involvement* (attachment) and *experienced incompatibilities* (separation, or some disruption to a gratifying relationship), which are characteristic for both normal psychological development and a successful therapeutic process (Behrends and Blatt, 1985; Blatt and Behrends, 1987).

To sum up, both the initially anaclitic and the initially introjective patients experienced to varying degrees a better balance between their affiliative and achievement-related needs. For some of them, this was accompanied by a feeling of loss of their previous exaggerated preoccupation with issues related to their initially predominant personality dimension. Furthermore, love and work, as dimensions of change in psychoanalysis, are supplemented by the dimension of the self-identity. Taken together, these findings might contribute to our deeper understanding of the complexity and dynamics of change, as experienced by patients in psychoanalysis.

Strengths, Limitations, and Further Directions

The findings from the present study were based on rich interview material, and they were analyzed by applying a discovery-oriented systematic qualitative methodology. The patients' implicit knowledge of their own change processes might have been overlooked had only quantitative methods been used (Klein and Elliott, 2006). However, the number of participants was limited. Furthermore, the interviews were not especially designed for the aims of the present study. The CHAP interviews at termination allowed only retrospective assessment of pre-treatment personality configurations. However, this interview protocol is aimed to explore differences between the patients' problems and life situation before and after psychotherapy. To increase the validity of PMAI assessment pre-treatment, both patient and therapist interviews were used.

Data analysis focused on descriptions of experienced changes, which might have led to underscoring of unchanged areas or impairments. The majority of participants were women, the patients suffered from long-term, severe symptoms, and were referred from psychiatric outpatient clinics to publicly financed psychoanalysis. Thus, the sample is not representative of typical patients in psychoanalysis. A further exploration of patterns of change, as experienced by anaclitic and introjective patients, requires a prospective design with larger samples in different treatment modalities and an interview protocol directly suited for the questions at issue. Additionally, combining qualitative data with quantitative measures within the three dimensions of change can contribute to a more nuanced picture of different paths to therapeutic change. Analyses of the anaclitic and the introjective patients' styles of verbal communication, and how changes in this aspect covariate with clinical improvement, can contribute to improved treatment techniques (cf. Fertuck et al., 2004).

Clinical Implications

Our study has demonstrated the importance of focusing on relevant differences and distinctive patterns for patients with different personality configurations. Initial assessment in terms of relatedness and self-definition might facilitate opportunities for the clinicians focusing on personality-related directions of change as well as barriers to change. The observation that positive changes might be accompanied by a feeling of losing former orientation in life, even if they considered the changes worth their price, suggests the necessity of therapeutic work on mourning previous ways of being. The mediating role of changes in the area of the self confirms the centrality of clinical work on strengthening the patient's self-observation and self-reflection capability and the sense of self-identity. This work has to take different directions with anaclitic and introjective patients. In the initial phase of psychoanalytic psychotherapy, the therapists' ability to adjust their orientation on relatedness or self-definition to be convergent their patients' predominant personality configuration can enhance treatment outcomes (Werbart et al., 2018). In the long run, the therapists' task is to challenge their patients' preoccupation with issues pertaining with their initial personality configuration, thus balancing gratifying involvement and experienced incompatibilities.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The research project has been reviewed and approved by the Regional Ethical Review Board at the Karolinska Institutet in Stockholm, Sweden (2012/356-31/5). All participants gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

AW was the project leader and principal investigator in the PPSS as well as in the present study, planned and designed the work, was responsible for the acquisition of all the data included, continuously scrutinized data analysis, the interpretation of results, and early drafting, and the preparation of the version to be submitted. AB contributed primarily with analysis and interpretation of the data for the work, early drafting, and with critical revision in the later stages of the work. SL contributed with critical revisions of data analysis and of the manuscript. They have also given final approval of the version to be published and agreed to be accountable for all aspects of the work.

FUNDING

The project was supported by grants from the International Psychoanalytic Association (IPA; 2012) and the Bertil Wennborg Foundation (2012).

ACKNOWLEDGMENTS

This study is based on archival data from the research project *Psychoanalysis in Public Service Setting* (PPSS) conducted at the former Institute of Psychotherapy, Stockholm County Council, Sweden. The authors would like to thank Maria Snapp for her contribution to the preliminary analysis of interview data.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 21 February 2020
doi: 10.3389/fpsyg.2020.00234

The Action of Verbal and Non-verbal Communication in the Therapeutic Alliance Construction: A Mixed Methods Approach to Assess the Initial Interactions With Depressed Patients

Luca Del Giacco[1,2]*, *M. Teresa Anguera*[3] *and Silvia Salcuni*[2]

[1] Department of Social Psychology and Quantitative Psychology, University of Barcelona, Barcelona, Spain, [2] Department of Developmental Psychology and Socialization, University of Padua, Padua, Italy, [3] Faculty of Psychology, Institute of Neurosciences, University of Barcelona, Barcelona, Spain

OPEN ACCESS

Edited by:
Giulio de Felice,
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Reviewed by:
Barbara Cordella,
Sapienza University of Rome, Italy
Omar Carlo Gioacchino Gelo,
University of Salento, Italy

***Correspondence:**
Luca Del Giacco
lucadelgiacco@gmail.com

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 03 October 2019
Accepted: 31 January 2020
Published: 21 February 2020

Citation:
Del Giacco L, Anguera MT and Salcuni S (2020) The Action of Verbal and Non-verbal Communication in the Therapeutic Alliance Construction: A Mixed Methods Approach to Assess the Initial Interactions With Depressed Patients. Front. Psychol. 11:234. doi: 10.3389/fpsyg.2020.00234

In psychodynamic psychotherapy, verbal (structures and intents) and non-verbal (voice and interruptions) dimensions of communication intertwine conveying information and determining the mutual regulation between therapist and patient through conversational sequences. The communication components interplay is the foundation for building the therapeutic alliance, a relational dimension that predicts a psychotherapy outcome and change, influenced by patient-therapist exchanges from the initial stages of their encounter. Depressed patients present specific verbal and non-verbal communication and show difficulties in developing and maintaining the therapeutic alliance. Based on the reviewed literature, the main aim of this study was to analyze how the action of specific communicative modes, implemented by the therapist and depressed patients, affect the reciprocal construction of the early therapeutic alliance by each participant during the mutual regulation processes. We employed a mixed methods approach based on a systematic observation of communication and alliance ruptures and repairs within the audio recordings and verbatim transcripts of 20 psychotherapy sessions (6,232 speaking turns) with seven depressed patients. The observational design was nomothetic, follow-up, and multidimensional. The choice of methodology is justified because we developed a comprehensive procedure that integrates an *ad hoc* indirect observation system (the Communicative Modes Analysis System in Psychotherapy), analyzing verbal and non-verbal communication, and an observational tool with deductive categories (the Collaborative Interactions Scale-Revised), assessing the therapeutic alliance construction. Once we confirmed the intra-and inter-observer reliability for the *ad hoc* system and the inter-rater reliability for the tool with deductive (or theoretical) categories, we performed descriptive statistics (to describe quantitatively communicative modes and alliance

ruptures and repairs), lag sequential analysis (to detect stable patterns in communication-alliance interactions), and polar coordinate analysis (to identify significant relationships between communicative modes and alliance ruptures and repairs). Results confirm that the therapist's verbal (asking and exploring) and non-verbal (elaborating and cooperatively interrupting) modes and the depressed patients' verbal (asserting and exploring) and non-verbal (expressing emotions and cooperatively interrupting) modes determine stable patterns and significant associations with collaborative behaviors connected to the reciprocal construction of alliance by each participant. All this may provide professionals with useful information to increase the psychotherapy effectiveness with depressed patients.

Keywords: verbal and non-verbal communication, performative language, therapeutic alliance construction, mutual regulation, coordination processes, psychotherapy process, depression, mixed-methods approach

INTRODUCTION

According to the psychodynamic approach, the therapeutic setting is the place where the therapist and patient establish a specific and asymmetric dialogue to explore and co-construct meanings through the intertwinement of verbal and non-verbal communication (Molina et al., 2013).

In psychotherapy research, these components of communication have always been considered independent (Westland, 2015) and studied separately (e.g., Salvatore et al., 2010; Tomicic et al., 2011; Ruiz-Sancho et al., 2013). However, in recent decades, scholars have been acknowledging the mutual influence of verbal and non-verbal dimensions as interrelated phenomena that can occur sequentially and simultaneously during communicative exchanges (Jones and LeBaron, 2002; Westland, 2015).

Assuming that people "co-construct and negotiate meanings in their ongoing interactions" (Jones and LeBaron, 2002, p. 504), we developed an integrative model of communication in psychotherapy (Del Giacco et al., 2019) to overcome the limits of previous research, based on the notion of performative language from the Speech Act Theory (SAT; Searle, 2017). According to our model, verbal and non-verbal dimensions are linguistic acts expressing the intents of speakers who co-construct a dynamic relationship through a two-way process that oscillates between self-and mutual regulation and is connected to psychotherapy change (Martinez Guzman et al., 2014; Westland, 2015). Precisely, voice and interruptions, together with verbal communication, assume a fundamental role in co-constructing meanings as, from one hand, they provide information on the psychological messages and emotional states underlying the participants' behaviors and, on the other hand, they enrich the speech through their interaction even though they are separate components (Jones and LeBaron, 2002). Therefore, verbal communication (through the structural form and communicative intents of the content), voice (through prosodic modulations), and cooperative/competitive interruptions (through behaviors of involvement or dominance) interact by spreading information and determining the mutual regulation between participants in the form of conversational sequences, observable and recordable during communicative exchanges (Li, 2001; Valdés et al., 2010; Tomicic et al., 2015b; Westland, 2015).

Scholars (e.g., Adigwe and Okoro, 2016; Rocco et al., 2018) agree that the dynamic interaction of verbal and non-verbal components is the foundation for building a good therapeutic alliance (TA) (Martinez Guzman et al., 2014), a collaborative dimension whose quality depends on the mutual interaction between therapist and patient as well as their respective contributions (Lingiardi et al., 2016). Different authors have proven that the TA is an active agent in the process of change in psychotherapy (Colli and Lingiardi, 2009; Flückiger et al., 2018; Uckelstam et al., 2018; Vernmark et al., 2019). In particular, the TA in the initial stages of psychotherapy predicts a better outcome and change than the one measured in the middle of psychotherapy (Flückiger et al., 2018): it seems to be stronger in the first session with peaks during the third one (Ardito and Rabellino, 2011). This relational dimension consists of a continuous negotiation process between the patient's and therapist's needs and passes through rupture and repairs moments implemented by both participants that influence change (Safran et al., 2011; Locati et al., 2019). Precisely, ruptures manifest themselves through phases of lack of coordination characterized by non-cooperative behaviors between participants, while repairs through coordination phases identified by cooperative behaviors; both of them are expressed through verbal and non-verbal communication (Colli and Lingiardi, 2009; Morán et al., 2016; Colli et al., 2017). The therapist's capacity to acknowledge and manage these moments could lead the therapy to positive changes or negative results (Eubanks et al., 2018). Therefore, the intersubjective negotiation in the therapeutic relationship involves a reciprocal regulation process that can itself be a mechanism of therapeutic change (Safran and Muran, 2003, 2006; Martinez Guzman et al., 2014): shifts in the collaboration and coordination levels can be considered fundamental keys of change (Colli and Lingiardi, 2009; Lingiardi et al., 2016).

Even though the literature acknowledges that the TA manifests itself through verbal and non-verbal expressions (Morán et al., 2016), studies mainly focused on verbal interactions (e.g., Krause

et al., 2016), giving little emphasis to research on non-verbal components (e.g., Rocco et al., 2018) and their interactions with the former (e.g., Martinez Guzman et al., 2014) in the TA construction. Therefore, deepening the relationship between communication and TA by considering the verbal and non-verbal dimensions as an integrated and interacting system (Del Giacco et al., 2019) may overcome the limits of the previous research and provide professionals with useful information to increase knowledge about building such a collaborative relationship and the therapy effectiveness.

Scholars attempted to determine what communicative actions patient and therapist reciprocally implement during change episodes, specific in-session segments characterized by verbal and non-verbal coordination between participants and associated with the TA co-construction (Mellado et al., 2017), confirming the essential role of verbal structures and intentions, voice, and interruptions. For example, Krause et al. (2016) detected that *asserting* something and *asking* for information represented the verbal structures connected to the coordination processes at the basis of change episodes and the TA construction. Furthermore, they proved that the patient tended to assert more than the therapist, while the latter was inclined to question more than the former. Dagnino et al. (2012) showed that *exploring* one's own or the other's experience was the main verbal communicative intention underlying the coordination sequences connected to change episodes in the initial stages of psychotherapy. Moreover, during this phase, patients tended to explore more than the therapist. Tomicic et al. (2015b) emphasized that, regardless of verbal content, both an *elaborative* and *emotional vocal quality* were associated with coordination processes between participants. Furthermore, the therapist highlighted a more elaborative voice than the patient, while the latter expressed a greater emotionality than the former in terms of vocal emission. Finally, Oka et al.[1] confirmed the mediating role of interruptions in the TA construction, although the results showed little effect of the cooperative vs. the competitive type. However, the patient implemented more competitive interruptions than the therapist, while the latter tended to interrupt more cooperatively than the former. Since research on the relationship between interruptions and TA is scarce in psychotherapy, we relied on studies in the field of communication (e.g., Li et al., 2005; Cafaro et al., 2016) to assume that the *cooperative interruptions*[2] can also support coordination processes in the TA construction.

Patients, therefore, live the therapeutic relationship and the alliance construction by manifesting different experiential and behavioral modalities through verbal and non-verbal communication (Tomicic et al., 2009; Valdés and Krause, 2015), as an expression of their psychological processes and symptoms (Valdés, 2014; Elvevåg et al., 2016). Depressed patients, in particular, show difficulties in developing and maintaining the TA because of the specific verbal and non-verbal correlates that define their communicative behaviors (Balsters et al., 2012; Smirnova et al., 2018). According to the psychodynamic approach, these behaviors reflect the broad range of depressed patients' defensive, adaptation, and cognition styles deriving from the early cognitive-affective representations where anger and aggression are predominant (Levy and Wasserman, 2009). This kind of patients has difficulty in accessing their inner world and emotions and in maintaining an adequate relational distance (Valdés, 2014; Valdés and Krause, 2015) which are manifested, on the one hand, through a rambling, repetitious, and vague speech (Bucci and Freedman, 1981), and from the other, through slow and monotonous speech with less volume and voice modulation (Rottenberg and Gotlib, 2004). These aspects vehicle the egocentric view of self, lack of empathy, interpersonal problems, and relational dependence typical of depressed patients who tend to exhibit hopelessness and passive-aggressive behaviors (Levy and Wasserman, 2009) through verbal and non-verbal communication that impact on the construction of a collaborative relationship.

As Hardy and Llewelyn (2015) point out, over the years, the study of the dynamics underlying the therapeutic relationship has involved the use of different methodologies (e.g., individual case studies, qualitative or quantitative analysis, naturalistic studies) and different analysis techniques (e.g., standardized methods, hermeneutics approaches, speech analysis) to provide empirical evidence aimed at explaining the role of factors that foster clinical change (e.g., Elliott et al., 2009; Eubanks et al., 2018; Smink et al., 2019). However, in recent decades, psychotherapy research has been moving toward an integrated approach of qualitative and quantitative methods, the mixed methods approach (Creswell and Plano Clark, 2017), to have a fuller picture of the ecological context of the therapeutic interaction supported by objective measures (Gelo et al., 2012; Bartholomew and Lockard, 2018). The systematic observation, deriving from this approach and considered being mixed methods in itself, represents the best technique and/or method to analyzed communication-alliance interactions since it offers both rigor and flexibility (Anguera et al., 2018), as proven by the broad range of observation tools created to analyze psychotherapy (e.g., Arias-Pujol and Anguera, 2017; Del Giacco et al., 2019) or other research areas (e.g., education, García-Fariña et al., 2018; sport, Tarragó et al., 2017). This scientific procedure, indeed, allows collecting qualitative data in observational records that are quantitized (Tashakkori and Teddlie, 1998) to obtain primary parameters (frequency, order, and duration) for carrying out quantitative analyses and identifying relationships between behaviors in systematized observational datasets (Anguera et al., 2017). In this study, we systematically observed the interactions between communication (as an integrated system of verbal and non-verbal dimensions) and the early TA construction in a group of depressed patients who show difficulties in developing and maintaining such a collaborative relationship because of their personality profile. For this purpose, we applied a peculiar and unconventional case of the observational method by developing a comprehensive procedure that integrates an *ad hoc* indirect observation system

[1]Oka, M., Tambling, R. B., Walker, J., Seedall, R. B., Robinson, W. D., and Anderson, S. R. (in press). Therapist interruptions: an examination of gender and therapeutic alliance in couple therapy. *J. Mar. Fam. Ther.*

[2]The constructs of the cited studies (*asking*, *asserting*, and *exploring* for the verbal dimension; *elaborating*, *expressing emotions*, and *cooperatively interrupting* for the non-verbal dimension) will correspond to the variables operationalized in the observational instrument that analyzes verbal and non-verbal communication in this research.

of verbal and non-verbal behaviors (the Communicative Modes Analysis System in Psychotherapy, CMASP; Del Giacco et al., 2018, 2019) and an observation instrument with deductive (or theoretical) categories for assessing the TA construction (the Collaborative Interactions Scale-Revised, CIS-R; Colli et al., 2014). Studies on such integration are limited and outdated (e.g., Bales and Cohen, 1979) and not focused on the interaction between communication and TA. In general, to our knowledge, no study has been conducted to observe systematically the micro-processes underlying the interaction of verbal (structures and intents) and non-verbal (voice and interruptions) communication with the TA construction in an Italian group of depressed patients by integrating a single observation system of communication with a tool based on deductive (or theoretical) categories for the alliance evaluation. We believe that this strategy may overcome the limits of previous research since it allows observing the complexity of mutual regulation processes between the therapist and the depressed patient from different perspectives at the same time.

Understanding the verbal and non-verbal communicative dynamics that promote the early TA construction between therapist and patients with depressive symptomatology can provide professionals with useful information to carry out interventions aimed, on the one hand, at containing the dysfunctional behavior of these patients and, on the other hand, at increasing the effectiveness of the therapy by laying the foundations for change. According to the previous theoretical background and the integration of two observational analysis techniques (lag sequential analysis and polar coordinate analysis) to obtain objective measures, this study aimed to analyze the action of specific communicative modes carried out by the therapist and depressed patients that foster the TA construction by each participant during the mutual regulation processes emerging in the initial stages of psychotherapy. Based on previous studies (Li et al., 2005; Dagnino et al., 2012; Tomicic et al., 2015b; Cafaro et al., 2016; Krause et al., 2016[1]), we expect that the therapist's verbal (*asking* and *exploring*) and non-verbal (*elaborating* and *cooperatively interrupting*) modes and the depressed patients' verbal (*asserting* and *exploring*) and non-verbal (*expressing emotions* and *cooperatively interrupting*) modes positively affect the reciprocal construction of the early TA, determining stable patterns and significant associations with collaborative behaviors by each participant.

MATERIALS AND METHODS

We applied the observational methodology to carry out a systematic observation of the interactions between communication (verbal and non-verbal behaviors) and TA ruptures and repairs during the mutual regulation processes between therapist and depressed patients, based on an exploratory sequential mixed methods approach (Fetters et al., 2013). Starting from an initial exploratory analysis of the 20 psychotherapy sessions whereby the *ad hoc* indirect observation system CMASP was built (Del Giacco et al., 2019), in this study, we performed an in-depth study of the observational methodology by exploring sequential patterns and statistically significant relationships between communication and TA through the CMASP and CIS-R use. As we mentioned, the observational methodology (considered being mixed methods in itself) is intensive and involves working with a small number of participants, but it allows us to collect a large number of registers with high rigor (e.g., Arias-Pujol and Anguera, 2017; García-Fariña et al., 2018) by mixing qualitative (QUAL) and quantitative (QUANT) data (Plano Clark et al., 2015). Such a methodology establishes three ordered stages (QUAL-QUANT-QUAL) that can be complemented based on different options. Creswell and Plano Clark (2017) recommended this integration according to the *connecting* strategy in addition to the *merging* and *embedding* strategies. We believe that the first strategy (*connecting* by building a dataset on the other) is the most optimal one in this study, given the qualitative nature of our data that reveals their transformative capacity to facilitate the integration. Therefore, starting from the QUAL stage, we obtained a descriptive qualitative dataset through the non-participant and indirect observation of the initial sessions of psychotherapy that was transformed in a systematized register by using the CMASP and CIS-R. The integration between the *ad hoc* indirect observation system and the tool with deductive or (theoretical) categories provides information about verbal, vocal, and interruption behaviors (the CMASP) and TA variations in the form of ruptures and repairs (the CIS-R). Each recorded session, indeed, provides a matrix of codes where each row represents the observed unit that expresses the co-occurrence of behaviors related to the dimensions of the two instruments. According to a quantification record process, the observational methodology provides the primary parameters of frequency, order, and duration organized based on a progressive order of inclusion (Bakeman, 1978; Anguera et al., 2017): from frequency (which supplies the least information) to duration (which adds time units besides the other two). Specifically, "the order parameter is crucial for detecting hidden structures through the quantitative analysis of relationships between different codes in systematized observational datasets" (Anguera et al., 2017, p. 6). This parameter (which also comprises frequency) is essential in the quantitizing process of our study because it is suitable for the defined purposes and the nature of data. Therefore, in the second stage (QUANT stage), after having tested and passed the data quality control, it is possible to perform analyses through different quantitative techniques for categorical data (e.g., lag sequential analysis, polar coordinate analysis, and detection of T-Patterns) obtaining quantitative results that can be qualitatively interpreted in the third and last stage (QUAL stage) based on the research problem. All this leads to a perfect integration (Anguera et al., 2017).

Design

The observational methodology provides eight observational designs deriving from the intersection of three dichotomous criteria (Blanco-Villaseñor et al., 2003; Portell et al., 2015): the unit of study, distinguished in *idiographic* (a single participant or a natural group of participants with a stable bond such as the family) and *nomothetic* (a group of participants) studies; the

continuity of recording, divided into single-session (*point*) and multiple-session (*follow-up*) studies; and the level of response (or dimensionality), differentiated between *unidimensional* (a single level) and *multidimensional* (multiple levels) designs. Each one is characterized by an increasing level of complexity that leads the study in terms of data collection, organization, and analysis (Anguera et al., 2018). We employed a Nomothetic/Follow-up/Multidimensional (N/F/M; Blanco-Villaseñor et al., 2003) design because it showed the highest level of complexity and information that fitted the complexity of this research. It was *nomothetic* because we studied different participants (therapist-patient interaction in seven psychotherapies), *follow-up* because we collected data over seven clinical cases of three successive sessions each (inter-sessional follow-up) and recorded each whole session without interruption (intra-sessional follow-up), and *multidimensional* because we observed communication (verbal, vocal, and interruption behaviors) and TA (ruptures and repairs) as an integrated system of different dimensions.

Participants and Materials

We selected the individual psychotherapies with 7 Italian university students (3 men and 4 women; age M = 26 years, SD = 3.91) self-referred to the Dynamic Psychotherapy Service (DPS) of the University of Padua (Italy) for problems of insecurity and difficulties in relationships and adaptation to the environment, low self-esteem, and deflected mood. They were treated by the same female therapist with 15 years of experience in brief focal psychotherapy, a form of once-a-week psychodynamic therapy lasting 15 sessions in which the therapist and patient develop the central focus of the treatment on a circumscribed problem area of discomfort for the latter during the initial assessment process (Rawson, 2018). Patients showed depressed symptomatology without psychiatric diagnosis detected through a previous screening to the assessment with the Beck Depression Inventory-II (BDI-II, Italian version; Ghisi et al., 2006) and the Symptom Checklist 90-Revised (SCL-90-R, Italian version; Sarno et al., 2011). The inclusion criteria for the patients' recruitment were (a) agreement to participate (signing the informed content to the research and tape recording), (b) initial assessment stage completed, (c) presence of depressive symptoms with scores $\geq$ 85th percentile in all scales (Total Score, Somatic-Affective Area, and Cognitive Area) of the BDI-II and T scores $\geq$ 60 in the Global Severity Index and the Depression Scale of the SCL-90-R. The exclusion criteria were (a) psychiatric diagnosis, (b) ongoing pharmacological treatments for depression, (c) previous psychological treatments. Each case of psychotherapy comprised of 14 sessions of 50 min each. The sessions were entirely recorded by an MP3 recorder that was discreetly positioned in the therapy room at the same distance from the therapist and patient to minimize the reactivity bias. Based on the objectives of our research, we selected the audio recordings of the first three sessions of each clinical case (corresponding to the initial stage of psychotherapy) for a total of 21 sessions. Afterward, we eliminated one session audio recording because it was not complete (it stopped after 10 min), so the final sample was 20 sessions. Each audio recording was verbatim transcribed based on the norms defined by the CMASP manual (Del Giacco et al., 2018), which made it possible to produce a transcript that was also suitable for use with CIS-R. Therefore, we observed a total of 20 audio recordings and their corresponding transcripts equivalent to 6,232 speaking turns (3,121 therapist speaking turns + 3,111 patient speaking turns).

Instruments

According to the systematic observation procedure (Anguera et al., 2018), recording instruments and the *ad hoc* observation instrument will be distinguished and described separately.

Recording Instruments

An MP3 audio recorder was used to record the psychotherapy sessions. We performed and used the verbatim transcription of each audio recording for indirect observation of verbal content. The Audacity® recording and editing software (v. 2.3.0; Audacity Team., 2018), a support instrument to listen, segment, trace, and code the audio tracks, was used to observe voice and interruption behaviors. We used Excel to report the codes of communication and TA.

Observational Instruments

The communicative modes analysis system in psychotherapy

The Communicative Modes Analysis System in Psychotherapy (CMASP; Del Giacco et al., 2018) is an *ad hoc* (Del Giacco et al., 2019) indirect observation system (Anguera et al., 2018) that determines the verbal, vocal, and interruption modes implemented by therapist and patient whereby they affect each other and co-construct meanings and psychological changes during communicative exchanges. It is a single classification system derived from the combination of two instruments of the observational method, the field format and category systems (Anguera et al., 2018), that is applied to audio recordings and verbatim transcripts and can be used at a global and dimension level (**Table 1**; for an in-depth description of the CMASP categories, see **Supplementary Appendix I**). The CMASP consists of four main dimensions based on the performative function of language (Searle, 2017): Verbal Mode-Structural Form (VeM-SF; six categories) and Verbal Mode-Communicative Intent (VeM-CI; eight categories) that evaluate the formal structure and communicative intent of verbal content, respectively; Vocal Mode (VoM; eight categories) that analyzes the communicative intent of the speaker's voice (regardless of verbal content) based on specific combinations of acoustic parameters impacting on the listener; Interruption Mode (IM; 11 categories) that identifies the interrupter's intent to support or hinder the communicative flow of the current speaker. This classification system comprises 33 categories derived from the observational method application and previous studies (Hill, 1978; Goldberg, 1990; Stiles, 1992; Murata, 1994; Li, 2001; Valdés et al., 2005, 2010; Krause et al., 2009; Tomicic et al., 2015a). Each dimension consists of a set of exhaustive and mutually exclusive (E/ME; Anguera et al., 2018) categories. The coder divides the audio recording and its verbatim transcript into speaking turns, each of which represents the unit of analysis. The verbatim transcript is the support to identify the structural form and communicative intent of verbal communication, while

TABLE 1 | Summary scheme of the Communicative Modes Analysis System in Psychotherapy (CMASP) (retrieved from Del Giacco et al., 2019).

Verbal Mode-Structural Form (VeM-SF)	Verbal Mode-Communicative Intent (VeM-CI)	Vocal Mode (VoM)	Interruption Mode (IM)
Courtesies (SF1)	Acknowledging (CI1)	Reporting (VM1)	Cooperative-Concurrence (IM1)
Assertion (SF2)	Informing (CI2)	Connected (VM2)	Cooperative-Assistance (IM2)
Question (SF3)	Exploring (CI3)	Declarative (VM3)	Cooperative-Clarification (IM3)
Agreement (SF4)	Deepening (CI4)	Introspective (VM4)	Cooperative-Exclamation (IM4)
Denial (SF5)	Focusing (CI5)	Emotional-Positive (VM5)	Intrusive-Disagreement (IM5)
Direction (SF6)	Temporizing (CI6)	Emotional-Negative (VM6)	Intrusive-Floor taking (IM6)
	Attuning (CI7)	Pure Positive Emotion (VM7)	Intrusive-Competition (IM7)
	Resignifying (CI8)	Pure Negative Emotion (VM8)	Intrusive-Topic change (IM8)
			Intrusive-Tangentialization (IM9)
			Neutral interruption (IM10)
			Failed Interruption (IM11)

the audio recording to detect vocal and interruption modes through careful listening. The coder attributes to each speaking turn one and only one predominant communicative mode of each dimension.

The collaborative interactions scale-revised

The Collaborative Interactions Scale-Revised (CIS-R; Colli et al., 2014) is the revised version of the CIS (Colli and Lingiardi, 2009), an observational tool with deductive or (theoretical) categories to assess ruptures and repairs of the TA through a micro-analytic evaluation of the therapeutic process (**Table 2**; for an in-depth description of the CIS-R categories, see **Supplementary Appendix II**). In this study, we used the CIS-R for a categorical coding by detecting the therapist's and depressed patients' ruptures and repairs at a speaking turn level. This transcript-based method, derived from Safran and Muran's (2003) theorization of TA, comprises two main scales for a total of 31 mutually exclusive and deductive categories: the Collaborative Interactions Scale-Therapist (CIS-T), to evaluate the therapist's positive and negative contributions to the therapeutic relationship, and the Collaborative Interactions Scale-Patient (CIS-P), to evaluate the patient's rupture and collaborative processes. The CIS-T is composed of the Form of the Therapist Intervention (TI) and the object of the therapist intervention. This last one is further divided into three subscales: Direct Collaborative Interventions (DCIs; four categories) and Indirect Collaborative Interventions (ICIs; three categories), the therapist's collaborative contributions directly or not directly related to the relationship with the patient or certain aspects of the therapy; and Rupture Interventions (RIs; five categories), the therapist's actions that negatively impact on the psychotherapy process. The CIS-P is composed of four subscales: Direct Collaborative Processes (DCPs; three categories) and Indirect Collaborative Processes (ICPs; three categories), the collaborative contributions to the TA construction directly or not directly related to the therapy and the therapeutic relationship; Direct Ruptures Markers (DRMs; four categories) and Indirect Rupture Markers (IRMs; five categories), the patient's ruptures of the TA directly or not directly related to the therapy. First, to evaluate the TA within a psychotherapy session, the transcript is divided into speaking turns, each of which represents the unit of analysis.

TABLE 2 | Summary scheme of the Collaborative Interactions Scale-Revised (CIS-R) (adapted from Colli et al., 2014).

CIS-Therapist	CIS-Patient
Form of Therapist Interventions (TI)	Direct Collaborative Processes (DCP)
Supportive (TI1)	Negotiation Tasks/Goals (DCP1)
Explicative (TI2)	Affects (DCP2)
Explorative (TI3)	Meaning (DCP3)
Expressive (TI4)	Indirect Collaborative Processes (ICP)
Direct Collaborative	Facts (ICP1)
Interventions (DCI)	Affects (ICP2)
Task/Goal (DCI1)	Meaning (ICP3)
Affects (DCI2)	Direct Rupture Markers (DRM)
Meaning (DCI3)	Task/Goal (DRM1)
Meta Communication (DCI4)	Relationship (DRM2)
Indirect Therapist Interventions (ICI)	Discouragement (DRM3)
Facts (ICI1)	Parameters (DRM4)
Affects (ICI2)	Indirect Rupture Markers (IRM)
Meaning (ICI3)	Linguistic Avoidance (IRM1)
Rupture Interventions (RI)	Affective Avoidance (IRM2)
Linguistic Avoidance (RI1)	Self-esteem Regulation Strategies (IRM3)
Affective Avoidance (RI2)	Indirect Allusions (IRM4)
Hostility (RI3)	Acquiescence (IRM5)
Perseveration (RI4)	
Lack of Clarity (RI5)	

The authors granted permission to use the CIS-R scheme.

Afterward, the speaking turns are grouped into narrative units, each one comprising a therapist-patient exchange. Finally, these are grouped into 10 homogeneous segments composing the psychotherapy session transcript.

As a first step, the coder performs a categorical coding by detecting ruptures or repairs that the therapist and patient implemented at a speaking turn level and attributing one and only one predominant category of the CIS-T or CIS-P, respectively. Afterward, it is possible to evaluate the TA trend within a psychotherapy session by applying a 4-point Likert scale to each coded category based on its frequency in all speaking turns of a segment. Moreover, it is possible to determine the intensity levels of ruptures and repairs for the therapist and patient, respectively, using a 3-point Likert scale at the global level. Finally, it is possible to obtain a TA global score for each psychotherapy session as a final result of the interactive processes between the ruptures and repairs of the therapist and patient.

Data Analysis Software

We used SPSS v. 23.0 statistics to perform the inter-rater reliability for the CIS-R and descriptive statistics. Moreover, the Generalized Sequential Querier computer program (GSEQ, v. 5.1.23; Bakeman and Quera, 2011) was used to carry out the intra-observer reliability for the CMASP and lag sequential analysis. Finally, we used the Tool for the Observation of Social Interaction in Natural Environments (HOISAN, v. 1.6.3.3.4; Hernández-Mendo et al., 2012) to perform the inter-observer reliability for the CMASP and the polar coordinate analysis.

Procedure

As we mentioned previously, the 20 psychotherapy sessions audio recordings were first verbatim transcribed according to the norms defined by the CMASP manual (Del Giacco et al., 2018). Then, we segmented each audio recording and its transcript to divide them into meaningful units (Anguera et al., 2018) based on the study purposes. To do this, we applied Krippendorff's unitizing procedure that consists in performing "systematic distinctions within a continuum of otherwise undifferentiated text—documents, images, voices, videos, websites, and other observables– that are of interest to an analysis, omitting irrelevant matter but keeping together what cannot be divided without loss of meaning" (Krippendorff, 2018, p. 88). As a result of such a procedure, we defined the division of audio recordings and their transcripts into speaking turns, and each one represented our unit of analysis. A turn comprised any speech of a speaker that ended when the other participant took the floor, marked in the audio trace through Audacity® software (v. 2.3.0; Audacity Team., 2018). The CIS-R unitizing procedure produced the same segmentation as the CMASP; for this reason, we could use the speaking turn as the unit of analysis for both instruments and the transcript as single support to report their codes.

The 20 sessions (corresponding to the first three sessions, the initial stage, of each psychotherapy) were analyzed to data collection and analysis. Firstly, we administered the CMASP to each psychotherapy session: VeM-SFs and VeM-CIs were coded by analyzing each speaking turn in the transcript, while VoMs and IMs by carefully listening to speaking turn in the audio recording through the Audacity software (v. 2.3.0; Audacity Team., 2018). Following the coding manual (Del Giacco et al., 2018), we applied one dimension of the CMASP at a time to each speaking turn of the therapist and patients and attributed one and only one predominant communicative mode of the dimension considered. A systematized register of verbal (structures and intents), vocal, and interruption modes resulted in the form of a matrix of codes where each speaking turn expressed multiple event codes (Bakeman, 1978). Then, the CIS-R was administered to verbatim transcripts based on its coding procedures (Colli et al., 2014). Each speaking turn of the therapist and patients were analyzed by CIS-T and CIS-P, respectively, assigning one and only one predominant code for the ruptures or repairs used. A systematized register of ruptures and repairs resulted in the form of a catalog where each speaking turn expressed event-based sequential data (Bakeman, 1978).

Before quantification of data resulting from indirect observation, Krippendorff (2018) recommends a rigorous data quality control for preventing possible biases from skewing results (Anguera et al., 2018). According to this, we performed the two main quantitative techniques for evaluating the reliability of data: intra-observer reliability, the agreement level of an observer in coding of the same psychotherapy session at two different times; and the inter-observer reliability, the agreement level of at least three observers in coding of the same psychotherapy session at the same time. Precisely, we tested the intra-and inter-observer reliability for the CMASP and the inter-rater reliability for the CIS-R. Following the procedure, we carried out the reliability check on 10% of all the sessions coded corresponding to two psychotherapy sessions in our study. Therefore, four trained judges independently coded such two sessions (equivalent to 503 speaking turns) drawn at random from the sample. The intra-observer reliability was calculated as the average Cohen's κ (Cohen, 1960) through GSEQ (v. 5.1.23; Bakeman and Quera, 2011). The inter-observer reliability was computed using Krippendorff's canonical agreement coefficient (Cc; Krippendorff, 1980) through HOISAN (v. 1.6.3.3.4; Hernández-Mendo et al., 2012). Finally, the inter-rater reliability of the tool with deductive (or theoretical) categories, equivalent to the inter-observer agreement of observational methodology, was calculated as the average of Cohen's κ through SPSS v. 23 statistics. The CMASP showed an average κ of 0.98 and an average Cc of 94%, confirming almost perfect intra-and inter-observer reliability for $\kappa \geq 0.81$ (Cohen, 1960) and Cc $\geq$ 81% (Krippendorff, 1980), respectively. The CIS-R presented an average κ of 0.79, indicating good inter-rater reliability ($0.61 \leq \kappa < 0.81$; Cohen, 1960).

After passing the data quality control, we performed a re-categorization process by grouping the data of some basic categories of CMASP into macro-categories with more global characteristics and appropriate to the extent of the constructs under investigation. Based on the reviewed studies on communication-TA interaction, indeed, the concepts of explorative intent (Dagnino et al., 2012), emotional voice (Tomicic et al., 2015b) and cooperative/intrusive interruptions[1] analyzed the reality of therapeutic exchanges at a more global level. Such re-categorization was possible since, in observational methodology, the everyday life of behavioral flow can be observed at different levels of *granularity* (Schegloff, 2000) "as a function of the possibilities ranging from most molar to most molecular" (Anguera, 2020, p. 52), characterized by greater interconnectedness (the molar level) or greater objectivity (the molecular level; Anguera, 2017), respectively. For this reason, we grouped the communicative intents Exploring (CI3), Deepening (CI4), and Focusing (CI5) within the macro-category Global Exploration (CIGE). The vocal categories Emotional-Positive (VM5) and Emotional-Negative (VM6), related to the expression of positive and negative emotions during verbalizations, were grouped in the macro-category Emotional (VME). Finally, we included all categories of interruptions related to cooperative and intrusive behaviors within the macro-categories Cooperative (IMC) and Intrusive (IMI), respectively.

Based on mixed methods approach, data resulting from CMASP and CIS-R application could then be merged in a comprehensive dataset (Fetters et al., 2013) since (a) their coding

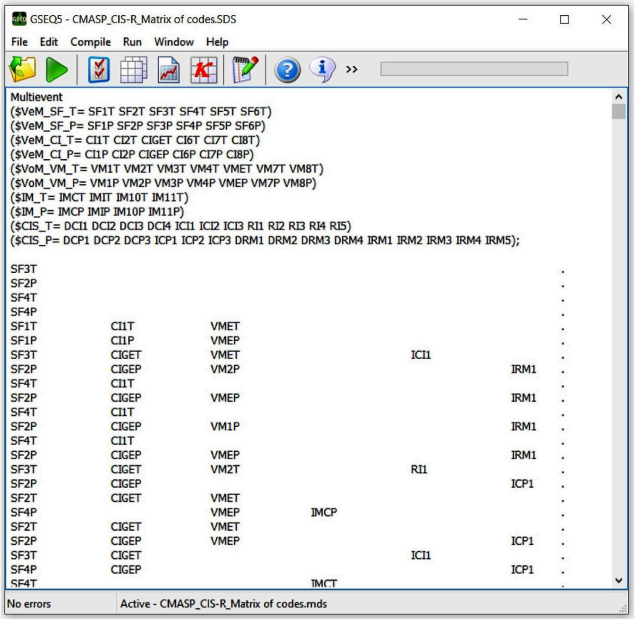


FIGURE 1 | Screenshot of CMASP and CIS-R merged data in the form of a code matrix in GSEQ (v. 5.1.23; Bakeman and Quera, 2011). Each row corresponds to the multiple and concurrent event codes of a speaking turn. T and P distinguish the therapist's and patients' codes in their respective speaking turns.

procedures fitted each other, (b) a predominant code could be attributed at a speaking turn level in both instruments, (c) the resulting data were categorical for both CMASP and CIS-R. Therefore, we obtained a systematized register of communicative modes and alliance ruptures and repairs in the form of a matrix of codes where each speaking turn of the therapist and depressed patients expressed multiple and co-occurrent event codes (Bakeman, 1978) of CMASP and CIS-R together (**Figure 1**).

Statistical Analyses

We used three statistical analysis techniques to answer the study aim: descriptive statistics, lag sequential analysis, and polar coordinate analysis.

Descriptive Statistics

We performed a macro-analytical analysis through SPSS Statistics (v. 23.0) to describe quantitatively the communicative modes and the alliance ruptures and repairs used by the therapist and depressed patients during communicative exchanges.

Lag Sequential Analysis

We performed lag sequential analysis (Bakeman and Quera, 2011) to identify the stable behavioral patterns connected to the TA construction deriving from the action of specific communicative modes in the initial stages of psychotherapy. This statistical technique is used in observational methodology to analyze the sequences of behaviors detected through direct and/or indirect observation, being effective in different research areas (e.g., psychotherapy, Venturella et al., 2019; education, Santoyo et al., 2017; sport, Tarragó et al., 2017). The first step consists in establishing the *criterion behaviors* (i.e., the trigger behaviors of any possible pattern detected) and applying time lags defined for the study. Afterward, the observed probabilities of co-occurring *conditional behaviors* (i.e., associated behaviors) are calculated for each lag by using the binomial test; this test produces adjusted residuals (Z; Allison and Liker, 1982) that express the strength of association between significantly associated categories (i.e., between the criterion behaviors and the associated conditional behaviors). The significance level was fixed at $p < 0.05$. Adjusted residuals can be prospective or retrospective depending on whether the lags are analyzed in a forward (lag+1, lag+2, etc.) or backward (lag-1, lag-2, etc.) direction from the criterion behavior. They are statistically significant for values > 1.96 (excitatory association) and < -1.96 (inhibitory association) between criterion and conditional behaviors. To evaluate the strength of patterns, Bakeman and Gottman (1987) defined interpretative rules which conventionally establish that (a) a pattern ends when two or more consecutive lags present non-significant behaviors, (b) a pattern weakens when two successive lags exhibit multiple behaviors (the first one is the last interpretable, called Max Lag).

Based on the study aim and the reviewed literature, we selected the following communicative modes as criterion behaviors: Question (SF3), Global Exploration (CIGE), Connected (VM2), and Cooperative (IMC) for the therapist; Assertion (SF2), Global Exploration (CIGE), Emotional (VME), and Cooperative (IMC) for depressed patients. The alliance ruptures and repairs were assumed as conditional behaviors. We considered only the CMASP and CIS-R categories with a frequency > 5 since behavioral occurrences less than this value are not significant in observational methodology practice (Sackett, 1980). Ten retrospective lags (from lag -10 to lag-1) and 10 prospective lags (from the lag+1 to lag $+10$) were analyzed to investigate the associations between communication and the TA construction. This choice, while not involving the exploration of all possible lags, allows us to adequately catch the complexity of the research object, making progress compared to the usual practice of analyzing only five lags (Sackett, 1980). The GSEQ program (v. 5.1.23; Bakeman and Quera, 2011) was used on multiple and concurrent event data.

Polar Coordinate Analysis

Polar coordinate analysis (Sackett, 1980; Anguera, 1997) identified the statistically significant relationships between one *focal behavior* (i.e., the behavior of interest) and *conditional behaviors* (i.e., associated behaviors). Such a quantitative analytical technique, widely used in different research areas (e.g., psychotherapy, Arias-Pujol and Anguera, 2017; education, Camerino et al., 2019; sport, Tarragó et al., 2017; interventions at the workplace, Portell et al., 2019), complements lag sequential analysis by reducing the volume of conditional probability data obtained by the latter through the Z_{sum} algorithm ($Z_{sum} = \frac{\sum Z}{\sqrt{n}}$, where Z is the standard value of each adjusted residual deriving from the sequential analysis and n is the number of lags;

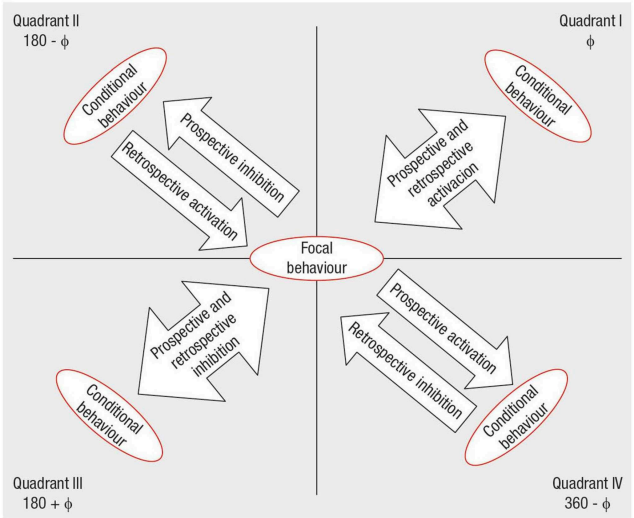


FIGURE 2 | Polar coordinates' vector map that depicts the relationship between the focal and conditional behaviors, based on the quadrant where the vector is located (retrieved from Aragón et al., 2016, p. 5). The authors granted permission to use the image.

Cochran, 1954). This statistic reflects the association between the focal behavior and each conditional behavior, and it is calculated for both prospective lags (Z_{sum} P, lags +1 to +5 or more) and retrospective lags (Z_{sum} R, lags −1 to −5 or less) (Sackett, 1980, 1987), obtaining a prospective and retrospective value for each conditional behavior. Anguera (1997) modified the original technique by introducing the concept of *genuine retrospectivity* to optimize the procedure. A vectorial depiction of the interrelationships between the focal behavior and each conditional behavior supports the analysis. Z_{sum} P and Z_{sum} R values are reported along the X and Y axes, respectively, defining the four quadrants of the vectors map where the focal behavior is the zero point (**Figure 2**). These values and the interaction between the positive or negative signs of Z_{sum} R and Z_{sum} P define the quadrant where each vector is located and its respective length (or radius) and angle (Sackett, 1980). The radius ($\text{Radius} = \sqrt{(Z_{sum}\ P)^2 + (Z_{sum}\ R)^2}$) expresses the strength of the relationship and is statistically significant for values > 1.96 with $p < 0.05$. The angle ($\phi = \frac{arcsine\ Z_{sum}\ R}{radius}$) shows the nature of the relationship and is adjusted as follows, depending on the quadrant where the vector is located: quadrant I ($0^\circ < \phi < 90^\circ$) $= \phi$; quadrant II ($90^\circ < \phi < 180^\circ$) $= 180^\circ - \phi$; quadrant III ($180^\circ < \phi < 270^\circ$) $= 180^\circ + \phi$; quadrant IV ($270^\circ < \phi < 360^\circ$) $= 360^\circ - \phi$.

Each quadrant indicates the (inhibitory vs. excitatory) association between the focal and conditional behaviors: Quadrant I (+ +) expresses a mutually excitatory relationship between the focal and conditional behaviors (i.e., they activate each other); in Quadrant II (– +), the focal behavior inhibits and, at the same time, is activated by the conditional behavior; Quadrant III (– –) shows a mutually inhibitory relationship between the focal and conditional behaviors (i.e., they inhibit each other); and in Quadrant IV (+ –), the focal behavior activates and, at the same time, is inhibited by the conditional behavior.

We chose the communicative modes related to the study aim as focal behaviors [Question (SF3), Global Exploration (CIGE), Connected (VM2), and Cooperative (IMC) for the therapist; Assertion (SF2), Global Exploration (CIGE), Emotional (VME), and Cooperative (IMC) for depressed patients] and alliance ruptures and repairs as conditional behaviors. The polar coordinate analysis and vectorial maps were performed through the HOISAN program (v. 1.6.3.3.4; Hernández-Mendo et al., 2012) considering 10 lags (from lag −10 to lag −1) for Z_{sum} R and 10 lags (from lag+1 to lag +10) for Z_{sum} P.

RESULTS

Firstly, we introduce the general results of the descriptive statistics obtained by applying the CMASP and CIS-R. Then, we focus on the lag sequential analysis and polar coordinate analysis of the specific communicative modes implemented by the therapist and depressed patients that affect the reciprocal construction of a positive TA by each participant during the mutual regulation processes in the initial stages of psychotherapy.

Main Communicative Modes Used by the Therapist and Depressed Patients

As shown in **Table 3**, from the comparison between the communicative modes used by the therapist and depressed patients during the initial stage of psychotherapy, the predominant structural forms characterizing their speech are Assertion (SF2), especially depressed patients, and Agreement (SF4) and Question (SF3), especially the therapist. The participants' verbal content mainly expresses communicative intents of Acknowledging (CI1), by taking the other's point of view about his/her experience (especially the therapist), and Global Exploration (CIGE) of his/her own or other's inner world (especially depressed patients). The vocal modes modulating the verbal content are mainly Connected (VM2), whereby participants perform elaborative processes in connection with themselves and oriented to the other (especially depressed patients), and Emotional (VME), whereby participants modulate speech through their emotional states (especially depressed patients). Finally, during communicative exchanges, participants mainly implement interruption modes of the type Cooperative (IMC) (especially the therapist).

Alliance Ruptures and Repairs Used by the Therapist and Depressed Patients

In **Table 4**, it is possible to notice that, during the initial phase of the psychotherapy, the therapist above all contributes to the TA through Indirect Collaborative Interventions (ICI) focused on Facts (ICI1), Affects (ICI2), and Meaning (ICI3) related to the depressed patients' experiences and through Direct Collaborative Interventions (DCI) related to the Task/Goals of the therapy (DCI1). Moreover, the therapist tends to break the TA through

TABLE 3 | CMASP categories distribution in the therapist and depressed patients ($N = 6,232$ speaking turns).

	Therapist ($n = 3,121$ speaking turns)		Patients group ($n = 3,111$ speaking turns)	
CMASP	**f**	**%**	**f**	**%**
Verbal Mode-Structural Form (VeM-SF)	2,750	88.11	2,997	96.34
Courtesies (SF1)	23	0.84	29	0.97
Assertion (SF2)	832	30.25	2,467	82.32
Question (SF3)	687	24.98	65	2.17
Agreement (SF4)	1,149	41.78	366	12.21
Denial (SF5)	11	0.40	69	2.30
Direction (SF6)	48	1.75	1	0.03
Not coded	371	11.89	114	3.66
Verbal Mode-Communicative Intent (VeM-CI)	2,503	80.20	2,668	85.76
Acknowledging (CI1)	1,108	44.27	167	6.26
Informing (CI2)	140	5.59	56	2.10
Global Exploration (CIGE)	832	33.24	2,202	82.53
Temporizing (CI6)	3	0.12	23	0.86
Attuning (CI7)	180	7.19	47	1.76
Resignifying (CI8)	240	9.59	173	6.48
Not coded	618	19.80	443	14.24
Vocal Mode (VoM)	1,419	45.47	2,413	77.56
Reporting (VM1)	2	0.14	8	0.33
Connected (VM2)	670	47.22	851	35.27
Declarative (VM3)	92	6.48	87	3.61
Introspective (VM4)	9	0.63	177	7.34
Emotional (VME)	339	23.89	1,214	50.31
Pure Positive Emotion (VM7)	287	20.23	46	1.91
Pure Negative Emotion (VM8)	20	1.41	30	1.24
Not coded	1,702	54.53	698	22.44
Interruption Mode (IM)	550	17.62	585	19. 09
Cooperative (IMC)	238	43.27	209	35.19
Intrusive (IMI)	171	31.09	180	30.30
Neutral Interruption (IM10)	96	17.45	190	31.99
Failed Interruption (IM11)	45	8.18	15	2.53
Not coded	2,571	82.38	2,526	81.20

Rupture Interventions (RI), mainly characterized by suddenly changing the topic in the form of Linguistic Avoidance (RI1) and by Hostility (RI3). On the other hand, depressed patients contribute to TA construction through Indirect Collaborative Processes (ICP) related to Facts (ICP1) and Affects (ICP2). Moreover, they implement Indirect Rupture Markers (IRM) characterized by Linguistic Avoidance (IRM1) and Affective Avoidance (IRM2).

Behavioral Patterns of Depressed Patients and Therapist in the Therapeutic Alliance Construction

Tables 5–8 show the sequential patterns of behaviors related to the TA construction in the therapist and depressed patients considering the communicative modes detected from the reviewed literature as criterion behaviors. We have structured the results into sections organized by the different four verbal and non-verbal dimensions that have been analyzed for the therapist and depressed patients. We will discuss only the behavioral patterns with Z values > 1.96 ($p < 0.05$), representing the excitatory relationships between criterion and conditional behaviors.

Verbal Mode-Structural Form

In **Table 5**, during the TA construction, the therapist's use of questions (SF3T) is followed and preceded with high probability by stable behavioral patterns of depressed patients expressed through collaborative processes related to the events experienced (ICP1). Moreover, such patients symmetrically activate collaborative processes on feelings and/or thoughts related to their experiences (ICP2), and only prospectively, collaborative processes focused on the therapy goals (DCP1).

Example:

Patient: This time, I decided not to stay home but to go out. (ICP1)
Therapist: How did you spend the day? (SF3T)
Patient: I went to the mountains with my girlfriend. (ICP1)

On the other hand, in the presence of assertions from depressed patients (SF2P), the therapist implements a stable and symmetrical pattern of collaborative interventions focused on patients' experiences (ICI1), supplemented by interventions on their feelings and/or thoughts (ICI2) in the lags immediately before and after the criterion behavior.

Example:

Therapist: Can you tell me something about your father? (ICI1)
Patient: My daddy grew up in Sicily, and when he speaks, he always gesticulates… (SF2P)
Therapist: For example,…. when does it happen? (ICI1)

Verbal Mode-Communicative Intent

In **Table 6**, the communicative intent Global Exploration (CIGET) -exploring, deepening, and focusing- of the therapist is followed and preceded with high probability by a stable pattern of depressed patients' collaborative processes related to the events experienced (ICP1); in prospective lags, such patients also activate collaborative processes on feelings and/or thoughts related to their experiences (ICP2).

Example:

Patient: We're trying to sell the house because it's too expensive for one person. (ICP1)

TABLE 4 | CIS-T and CIS-P items distribution (N = 6,232 speaking turns).

	Therapist (n = 3,121 speaking turns)			Patients group (n = 3,111 speaking turns)	
CIS-R	***f***	**%**		***f***	**%**
CIS-Therapist (CIS-T)	1,215	38.93	CIS-Patient (CIS-P)	2,529	81.29
Direct Therapist Intervention (DCI)	165	13.58	Direct Collaborative Processes (DCP)	98	3.88
Task/Goal (DCI1)	137	11.28	Negotiation Tasks/Goals (DCP1)	48	1.90
Affects (DCI2)	19	1.56	Affects (DCP2)	48	1.90
Meaning (DCI3)	9	0.74	Meaning (DCP3)	2	0.08
Meta communication (DCI4)	0	0.00	Indirect Collaborative Processes (ICP)	1,106	43.73
Indirect Therapist Intervention (ICI)	787	64.77	Facts (ICP1)	786	31.08
Facts (ICI1)	455	37.45	Affects (ICP2)	227	8.98
Affects (ICI2)	177	14.57	Meaning (ICP3)	93	3.68
Meaning (ICI3)	155	12.76	Direct Rupture Marker (DRM)	40	1.58
Rupture Interventions (RI)	263	21.65	Task/Goal (DRM1)	2	0.08
Linguistic Avoidance (RI1)	140	11.52	Relationship (DRM2)	35	1.38
Affective Avoidance (RI2)	0	0.00	Discouragement (DRM3)	0	0.00
Hostility (RI3)	122	10.04	Parameters (DRM4)	3	0.12
Perseveration (RI4)	1	0.08	Indirect Rupture Marker (IRM)	1,285	50.81
Lack of Clarity (RI5)	0	0.00	Linguistic Avoidance (IRM1)	798	31.55
Not coded	1,906	61.07	Affective Avoidance (IRM2)	337	13.33
			Self-esteem Regulation Strategies (IRM3)	43	1.70
			Indirect Allusions (IRM4)	26	1.03
			Acquiescence (IRM5)	81	3.20
			Not coded	582	18.71

Therapist: There's also, um, a difficult choice, that is, this choice to leave the house… (CIGET)
Patient: No, no, um, we're not... my sister and I aren't going to be there anymore.. (ICP1)

Symmetrically, when depressed patients express the speech with the communicative intent Global Exploration (CIGEP), the therapist is likely to activate a stable pattern that precedes and follows such a criterion behavior, characterized by collaborative interventions on patients' experiences (ICI1) that are supplemented by interventions on their feelings and/or thoughts (ICI2).

Example:

Therapist: How's your relationship now? (ICI1)
Patient: Well, there's…um… respect between my boyfriend and me. (CIGEP)
Therapist: Do you still work together? (ICI1)

Vocal Mode

In **Table 7**, in the presence of the therapist's elaborative vocal mode (VM2T), depressed patients retrospectively activate (up to delay −3) collaborative processes on feelings and/or thoughts related to their experiences (ICP2), and prospectively (up to delay +3), collaborative processes related to the events experienced (ICP1), the therapy goals (DCP1), and their feelings toward the therapist and therapy (DCP2).

Example (from the audio track coding):

Patient: I feel happy when I listen to music! (ICP2)
Therapist: Last time, you were telling me that this is your biggest passion… (pause). (VM2T)
Patient: Yes! … I started late because I was 18 years old, but it was love at first sight. (ICP1)

On the other hand, in the presence of the depressed patients' emotional vocal mode (VMEP), the therapist symmetrically activates (up to lags −3 and +3) a pattern of collaborative interventions on feelings and/or thoughts of patients linked to their experiences (ICI2), integrated by collaborative interventions related to the patients' feelings toward the therapy and the therapist (DCI2).

Example (from the audio track coding):

Therapist: Wouldn't you have liked…to…to go to Japan too? (ICI2)
Patient: I think I'd be a different person with that kind of experience in Japan! (VMEP)
Therapist: Uhm! And what kind of person do you think you would be? (ICI2)

Interruption Mode

In **Table 8**, the therapist's use of cooperative interruption modes (IMCT) is followed and preceded with high probability by a stable pattern of depressed patients' collaborative processes related to the events experienced (ICP1). Moreover, such patients symmetrically activate collaborative processes on feelings and/or thoughts related to their experiences (ICP2), and

TABLE 5 | Depressed patients' and therapist's behavioral patterns in the alliance construction due to the action of the reciprocal structural forms.

Lag −10	Lag −9	Lag −8	Lag −7	Lag −6	Lag −5	Lag −4	Lag −3	Lag −2	Lag −1	CB	Lag +1	Lag +2	Lag +3	Lag +4	Lag +5	Lag +6	Lag +7	Lag +8	Lag +9	Lag +10
ICP1 (3.69)	ICP1 (4.77)	ICP1 (5.80)	ICP1 (3.10)	ICP1 (3.94)	ICP1 (5.28)	ICP1 (3.27)	ICP1 (6.98)	ICP1 (3.23)	ICP1 (6.70)	SF3T	ICP1 (9.60)	ICP1 (2.85)	ICP1 (7.21)	DCP1 (2.81)	ICP1 (6.33)	ICP2 (3.86)	ICP1 (5.89)	ICP2 (2.87)	ICP1 (5.19)	**ICP1 (2.49)**
						ICP2 (2.79)								ICP1 (2.75)		DCP1 (2.52)			ICP2 (2.10)	
IRM1 (−3.52)	*IRM1 (−2.63)*	*IRM1 (−2.59)*	*IRM1 (−2.52)*	*IRM1 (−2.33)*	*IRM1 (−4.38)*	*IRM5 (−2.31)*	*IRM1 (−5.56)*	*ICP3 (−2.39)*	***IRM1 (−4.84)***		*IRM1 (−5.05)*	*IRM1 (−4.20)*	*IRM5 (−4.37)*	*IRM1 (−2.93)*	***IRM1 (−4.18)***	*IRM1 (−2.68)*	*IRM1 (−2.96)*	*IRM1 (−2.90)*	*IRM1 (−3.87)*	*DRM2 (−2.24)*
	IRM5 (−2.12)		*IRM5 (−2.51)*	*IRM5 (−1.98)*	*DCP2 (−2.31)*	*IRM1 (−2.20)*	*IRM5 (−2.17)*	*DRM2 (−2.16)*	***IRM5 (−2.10)***		*IRM2 (−3.14)*		*IRM1 (−4.36)*		***IRM5 (−3.22)***	*IRM5 (−2.68)*	*IRM5 (−2.91)*	*DRM2 (−2.06)*	*IRM5 (−3.20)*	
						DRM2 (−2.16)					*IRM5 (−2.74)*						*DRM2 (−2.06)*		*ICP3 (−2.13)*	
																			DRM2 (−2.00)	
ICI1 (3.27)	ICI1 (4.20)	ICI1 (3.84)	ICI1 (4.89)	ICI1 (3.70)	ICI1 (5.52)	ICI1 (3.18)	ICI1 (7.49)	ICI1 (2.52)	ICI1 (8.57)	SF2P	ICI1 (9.43)	ICI1 (3.83)	ICI1 (7.81)	ICI1 (4.35)	ICI1 (5.41)	ICI2 (2.34)	ICI1 (4.41)	ICI1 (2.93)	ICI1 (5.50)	**ICI1 (2.33)**
					ICI2 (2.92)		ICI2 (4.58)		ICI2 (4.64)		ICI2 (3.42)		ICI2 (3.96)		ICI2 (2.61)					
DCI1 (−3.31)	*DCI1 (−5.10)*	*DCI1 (−4.16)*	*DCI1 (−7.14)*	*DCI1 (−4.12)*	*DCI1 (−6.47)*	*DCI1 (−4.71)*	*DCI1 (−7.63)*	*ICI3 (−2.73)*	***DCI1 (−8.88)***		*ICI3 (−7.64)*	*DCI1 (−3.89)*	***DCI1 (−7.40)***	*DCI1 (−3.60)*	*DCI1 (−6.33)*	*DCI1 (−3.16)*	*DCI1 (−3.82)*	*DCI1 (4.02)*	*DCI1 (−3.06)*	*DCI1 (−3.63)*
ICI3 (−3.25)	*RI1 (−2.45)*	*ICI3 (−3.37)*	*RI1 (−2.46)*		*ICI3 (−3.35)*		*ICI3 (−4.83)*	*DCI3 (−2.27)*	***ICI3 (−7.78)***		*DCI1 (−7.32)*		***ICI3 (−4.16)***	*ICI3 (−2.74)*	*ICI3 (3.17)*	*ICI3 (−3.17)*	*ICI3 (−2.30)*		*ICI3 (−2.83)*	
ICI3 (−2.02)					*RI1 (−2.56)*		*RI1 (−2.93)*						***RI3 (−2.75)***	*DCI2 (−2.23)*						
													DCI2 (−1.98)							

Structural Form (Therapist)-CIS (Patient) Interaction*: Criterion Behavior (CB): structural form Question (SF3T); Conditional Behaviors: Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1), Affective Avoidance (IRM2), and Acquiescence (IRM5).* ***Structural Form (Patient)-CIS (Therapist) Interaction****: Criterion Behavior (CB): structural form Assertion (SF2P); Conditional behaviors: Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3). Z values > 1.96 indicate the excitatory relationships; Z values <-1.96 (in italics) indicate the inhibitory relationships; categories in bold indicate the Max lag and the end of the pattern; significance level at $p < 0.05$.*

TABLE 6 | Depressed patients' and therapist's behavioral patterns in the alliance construction due to the action of the reciprocal communicative intents.

Lag −10	Lag −9	Lag −8	Lag −7	Lag −6	Lag −5	Lag −4	Lag −3	Lag −2	Lag −1	CB	Lag +1	Lag +2	Lag +3	Lag +4	Lag +5	Lag +6	Lag +7	Lag +8	Lag +9	Lag +10
ICP1 (3.73)	ICP1 (3.66)	ICP1 (4.28)	ICP1 (4.72)	IRM3 (3.59)	ICP1 (5.96)	ICP1 (4.26)	ICP1 (7.31)	ICP1 (6.75)	ICP1 (8.53)	CIGET	ICP1 (11.37)	ICP1 (5.97)	ICP1 (7.24)	ICP1 (4.86)	ICP1 (5.87)	ICP1 (3.56)	ICP1 (4.90)	ICP1 (3.64)	ICP1 (5.96)	**ICP1 (4.21)**
				ICP1 (3.50)		ICP2 (2.06)							ICP2 (2.23)			ICP2 (2.45)		ICP2 (2.53)		**ICP2 (3.14)**
IRM1 (−2.89)	*DCP2 (−2.19)*	*IRM1 (−2.69)*	*IRM5 (−2.71)*	*IRM1 (−2.36)*	*IRM1 (−3.77)*	*DCP1 (−2.71)*	*IRM1 (−5.30)*	*ICP3 (−3.48)*	***IRM1 (−4.57)***		***IRM1 (−5.28)***	*IRM1 (−5.28)*	*IRM1 (−4.38)*	*IRM1 (−3.73)*	*IRM1 (−4.15)*	*IRM1 (−3.74)*	*DRM2 (−2.62)*	*IRM1 (−2.59)*	*IRM1 (−3.18)*	*IRM1 (−3.20)*
DCP2 (−2.39)		*IRM5 (−2.24)*	*IRM1 (−2.20)*	*ICP3 (−2.03)*	*IRM5 (−2.21)*	*IRM1 (−2.64)*	*DCP1 (−2.98)*	*DCP1 (−2.75)*	***DCP1 (−2.26)***		***IRM2 (−3.21)***	*DCP1 (−3.64)*	*DCP1 (−3.05)*	*DCP1 (−2.58)*	*DRM2 (−2.06)*		*IRM2 (−2.07)*	*DRM2 (−2.43)*	*DRM2 (−2.89)*	*IRM5 (−2.69)*
IRM5 (−2.38)		*DCP2 (−2.14)*				*DCP2 (−2.48)*	*IRM5 (−2.43)*	*DRM2 (−2.22)*	***IRM5 (−2.12)***		***ICP3 (−2.54)***	*IRM5 (−2.63)*	*IRM5 (−2.35)*	*IRM5 (−2.20)*			*DCP1 (−1.97)*	*IRM1 (−2.40)*	*DCP1 (−2.86)*	*DRM2 (−2.18)*
						DRM2 (−2.37)	*DCP2 (−2.07)*	*IRM1 (−2.15)*			***IRM5 (−2.50)***								*IRM2 (−1.97)*	
											DCP1 (−2.29)									
ICI1 (6.04)	ICI1 (5.77)	ICI1 (6.02)	ICI1 (6.67)	ICI1 (6.96)	ICI1 (9.10)	ICI1 (6.58)	ICI1 (10.82)	ICI1 (5.88)	ICI1 (12.30)	CIGEP	ICI1 (10.20)	ICI1 (6.25)	ICI1 (7.99)	ICI1 (4.94)	ICI1 (6.72)	ICI1 (3.58)	ICI1 (4.74)	ICI1 (4.25)	ICI1 (4.56)	**ICI1 (4.47)**
		ICI2 (2.34)			ICI2 (2.02)				ICI2 (3.71)		ICI2 (2.54)		ICI2 (2.86)			IC2 (2.13)				
DCI1 (−7.30)	*DCI1 (−6.63)*	*DCI1 (−8.61)*	*DCI1 (−7.67)*	*DCI1 (−6.98)*	*DCI1 (−7.75)*	*DCI1 (−6.37)*	*DCI1 (−8.14)*	*DCI1 (−6.73)*	***DCI1 (−9.70)***		***ICI3 (−8.67)***	*DCI1 (−5.46)*	*ICI3 (−5.68)*	*ICI3 (−4.30)*	*DCI3 (−5.17)*	*ICI3 (−4.98)*	*ICI3 (−4.38)*	*ICI3 (−4.70)*	*ICI3 (−2.96)*	*ICI3 (−5.81)*
ICI3 (−4.11)	*ICI3 (−2.97)*	*ICI3 (−2.21)*	*DCI3 (−3.32)*	*DCI3 (−2.95)*	*ICI3 (−5.03)*	*DCI3 (−4.10)*	*ICI3 (−6.37)*	*ICI3 (−3.34)*	***ICI3 (−9.57)***		***DCI1 (−7.44)***	*ICI3 (−3.64)*	*DCI1 (−5.20)*	*DCI1 (−3.84)*	*ICI3 (−4.58)*	*DCI2 (−2.32)*	*DCI3 (−3.18)*	*DCI3 (−2.48)*	*DCI3 (−2.94)*	*DCI1 (−2.93)*
DCI3 (−2.62)	*DCI3 (−2.73)*	*DCI3 (−2.12)*	*ICI3 (−2.71)*		*DCI3 (−2.67)*	*DCI2 (−2.15)*	*RI1 (−2.91)*		***RI1 (−4.29)***		***DCI3 (−2.75)***	*DCI2 (−3.52)*	*DCI3 (−3.70)*	*DCI3 (−3.52)*	*DCI1 (−3.03)*	*DCI1 (−2.23)*			*DCI2 (−2.47)*	
	RI1 (−1.99)	*DCI2 (−1.99)*	*RI1 (−2.42)*		*RI1 (−2.33)*		*DCI3 (−2.63)*					*DCI3 (−2.58)*	*RI3 (−2.69)*		*DCI2 (−2.84)*	*DCI3 (−2.09)*			*DCI1 (−2.05)*	
					DCI2 (−2.01)		*DCI2 (−2.33)*								*RI3 (−2.11)*					

Communicative Intent (Therapist)-CIS (Patient) Interaction*: Criterion Behavior (CB): communicative intent Global Exploration (CIGET); Conditional Behaviors: Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1), Affective Avoidance (IRM2), Self-esteem Regulation Strategies (IRM3), and Acquiescence (IRM5).* ***Communicative Intent (Patient)-CIS (Therapist) Interaction****: Criterion Behavior (CB): communicative intent Global Exploration (CIGEP); Conditional behaviors: Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3). Z values > 1.96 indicate the excitatory relationships; Z values <-1.96 (in italics) indicate the inhibitory relationships; categories in bold indicate the Max lag and the end of the pattern; significance level at $p < 0.05$.*

TABLE 7 | Depressed patients' and therapist's behavioral patterns in the alliance construction due to the action of the reciprocal vocal modes.

Lag −10	Lag −9	Lag −8	Lag −7	Lag −6	Lag −5	Lag −4	Lag −3	Lag −2	Lag −1	CB	Lag +1	Lag +2	Lag +3	Lag +4	Lag +5	Lag +6	Lag +7	Lag +8	Lag +9	Lag +10
ICP3 (2.01)	ICP2 (2.62)					**ICP2 (2.05)**	ICP2 (2.35)	ICP2 (2.52)	ICP2 (2.95)	VM2T	ICP1 (2.89)	ICP1 (2.53)	**DCP2 (2.35)**			IRM3 (2.07)				DRM2 (2.09)
											DCP1 (2.57)									DCP1 (2.01)
DCP1 (−2.45)				***IRM5 (−2.80)***		*DCP1 (−2.71)*	*DRM2 (−2.13)*	*DRM2 (−2.00)*	*IRM1 (−2.97)*		*IRM1 (−4.20)*	*IRM1 (−2.26)*	***IRM1 (−2.18)***							
						IRM5 (−2.13)														
		ICI3 (2.07)					**ICI2 (2.00)**	ICI2 (2.40)	DCI2 (2.95)	VMEP	ICI2 (2.80)	ICI2 (2.09)	**DCI2 (2.15)**			ICI3 (2.60)	ICI3 (2.57)	ICI3 (3.17)	ICI3 (2.54)	ICI3 (2.06)
																	DCI2 (2.12)		DCI2 (2.51)	DCI2 (2.06)
	DCI1 (−2.27)			*DCI3 (−2.28)*			***DCI3 (−2.42)***	*ICI1 (−1.99)*						*RI1 (−2.24)*				*ICI2 (−2.20)*	*ICI1 (−2.34)*	
				ICI2 (−1.99)																

Vocal Mode (Therapist)-CIS (Patient) Interaction*: Criterion Behavior (CB): vocal mode Connected (VM2T); Conditional Behaviors: Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1), Self-esteem Regulation Strategies (IRM3), and Acquiescence (IRM5).* ***Vocal Mode (Patient)-CIS (Therapist) Interaction****: Criterion Behavior (CB): vocal mode Emotional (VME); Conditional behaviors: Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1). Z values > 1.96 indicate the excitatory relationships; Z values < −1.96 (in italics) indicate the inhibitory relationships; categories in bold indicate the Max lag and the end of the pattern; significance level at $p < 0.05$.*

TABLE 8 | Depressed patients' and therapist's behavioral patterns in the alliance construction due to the action of the reciprocal interruption modes.

Lag −10	Lag −9	Lag −8	Lag −7	Lag −6	Lag −5	Lag −4	Lag −3	Lag −2	Lag −1	CB	Lag +1	Lag +2	Lag +3	Lag +4	Lag +5	Lag +6	Lag +7	Lag +8	Lag +9	Lag +10
ICP2 (2.57)		ICP2 (2.24)			**ICP1 (2.74)**	ICP1 (3.27)	ICP1 (2.51)	ICP1 (2.07)	ICP1 (3.60)	IMCT	ICP1 (3.60)	ICP1 (2.71)	ICP1 (2.96)	ICP1 (1.98)	ICP3 (2.02)	**ICP2 (2.80)**				
					IRM5 (−2.11)	*IRM2 (−2.06)*			***DCP1 (−3.07)***		*IRM5 (−2.17)*		*DCP1 (−2.05)*		*IRM1 (−2.13)*	***IRM1 (−2.08)***				
			ICI2 (3.27)		DCI1 (2.36)	DCI1 (3.03)	DCI1 (2.62)	DCI1 (2.62)	DCI1 (3.70)	IMCP	DCI1 (3.27)	DCI1 (2.45)	DCI1 (2.90)	DCI1 (2.65)	DCI1 (2.04)		**DCI1 (2.15)**			
			DCI1 (2.26)						ICI3 (2.68)		ICI3 (3.24)						**DCI2 (1.99)**			
		RI1 (−2.80)	*ICI1 (−2.41)*						***ICI1 (−3.44)***		*RI3 (−4.24)*		*ICI1 (−2.21)*	***ICI2 (−2.06)***						

Interruption Mode (Therapist)-CIS (Patient) Interaction*: Criterion Behavior (CB): interruption mode Cooperative (IMCT); Conditional Behaviors: Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1), Self-esteem Regulation Strategies (IRM3), and Acquiescence (IRM5).* ***Interruption Mode (Patient)-CIS (Therapist) Interaction****: Criterion Behavior (CB): interruption mode Cooperative (IMCP); Conditional behaviors: Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3). Z values > 1.96 indicate the excitatory relationships; Z values < −1.96 (in italics) indicate the inhibitory relationships; categories in bold indicate the Max lag and the end of the pattern; significance level at $p < 0.05$.*

only prospectively, collaborative processes related to the deep meaning of the events experienced (ICP3).

Example (from the audio track coding):

Patient: I wasn't feeling well, so I made up an… an…ex// (interrupted) (ICP1)
Therapist: //an excuse? (IMCT)
Patient: Yes… but in the end, I told her the truth, and she was very understanding of me. (ICP1)

On the other hand, in the presence of a cooperative interruption mode by depressed patients (IMCP), the therapist activates with high probability a stable pattern of collaborative interventions focused on the therapy goals and tasks (DCI1). Such behaviors of the therapist are symmetrically integrated by interventions related to the meaning of patients' experiences (ICI3), retrospectively, by interventions on feelings and/or thoughts of patients about their experiences (ICI2), and prospectively, by interventions on patients' feelings toward the therapy and/or the therapist (DCI2).

Example (from the audio track coding):

Therapist: If you agree, I'd like to meet you for a few sessions to discuss your problems together and see how to proceed// (interrupted) (DCI1)
Patient: //What do you mean "how to proceed"? (IMCP)
Therapist: What to advise you on, how to deal with your difficulties… (DCI1)

Relationships Between the Communicative Modes and the Construction of the Therapeutic Alliance

Figures 3–6 show the results of the polar coordinate analysis for the therapist and depressed patients. Each vectorial map represents the statistically significant associations between each communicative mode (i.e., each focal behavior detected from the reviewed literature) and the behaviors connected to the TA construction (i.e., conditional behaviors). The statistically significant association is shown both qualitatively (Quadrant I, II, III, or IV) and quantitatively (vector length). Again, the results are structured into sections based on the four verbal and non-verbal dimensions that we analyzed for the therapist and depressed patients. We will discuss the vectors with a length >1.96 ($p < 0.05$), expressing the relationships between focal behaviors' and conditional behaviors' activations in each vectorial map.

Relationships Between the Structural Forms Used by the Therapist and Depressed Patients and the Reciprocal Construction of the Therapeutic Alliance

Figure 3A shows the mutual activation (Quadrant I) between the structural form Question (SF3T) used by the therapist and the collaborative processes of depressed patients related to the TA construction. In particular, we can notice a strong mutual excitatory relationship with collaborative processes related to the events experienced by such patients (ICP1). Moreover, although with less intensity, there are mutually excitatory relationships with depressed patients' collaborative processes on feelings and/or thoughts related to their experiences (ICP2) and on the therapy goals and tasks (DCP1). On the other hand, in **Figure 3B**, there is a mutual activation (Quadrant I) between the structural form Assertion (SF2P) used by depressed patients and the therapist's collaborative interventions on the events experienced by this last one (ICI1).

Relationships Between the Communicative Intents Used by the Therapist and Depressed Patients and the Reciprocal Construction of the Therapeutic Alliance

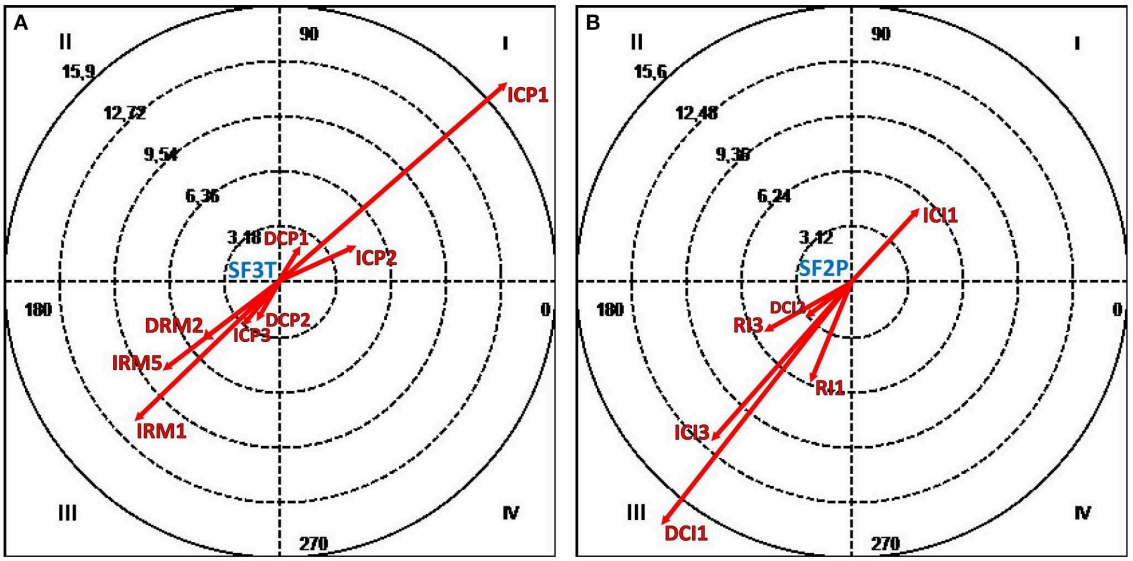
In **Figure 4A**, there is above all a mutually excitatory relationship (Quadrant I) between the communicative intent Global Exploration (CIGET) used by the therapist and collaborative processes of depressed patients related to the events experienced (ICP1). Furthermore, there are mutual excitatory relationships with depressed patients' collaborative processes on feelings and/or thoughts related to their experiences (ICP2). Symmetrically, in **Figure 4B**, the depressed patients' use of the communicative intent Global Exploration (CIGEP) involves a mutual activation (Quadrant I) with the therapist's collaborative interventions on the events experienced by depressed patients (ICI1), and with less intensity, with collaborative interventions focused on thoughts and/or feelings about their experiences (ICI2).

Relationships Between the Vocal Modes Used by the Therapist and Depressed Patients and the Reciprocal Construction of the Therapeutic Alliance

In **Figure 5A**, the therapist's use of the vocal mode Connected (VM2T) determines mutually excitatory relationships (Quadrant I) with depressed patients' collaborative processes on feelings and/or thoughts related to their experiences (ICP2), feelings toward the therapist and therapy (DCP2), the therapy goals and tasks (DCP1), and the deep meaning of the events experienced (ICP3). On the other hand, in **Figure 5B**, the depressed patients' use of the vocal mode Emotional (VMEP) involves mutual activations (Quadrant I) with the therapist's collaborative interventions on patients' feelings toward the therapy and/or the therapist (DCI2) and on the feelings and/or thoughts of patients about their experiences (ICI2). Moreover, the vocal mode Emotional (VMEP) activates (Quadrant IV) the therapist's collaborative interventions on the meaning of the episodes that occur with patients during the psychotherapy session to identify behavioral patterns in the relationship with them (DCI3).

Relationships Between the Interruption Modes Used by the Therapist and Depressed Patients and the Reciprocal Construction of the Therapeutic Alliance

Figure 6A shows the mutually excitatory relationship (Quadrant I) between the therapist's use of the interruption mode Cooperative (IMCT) and depressed patients' collaborative processes related to the events experienced (ICP1). In **Figure 6B**, there are mutual activations (Quadrant I) between the depressed patients' use of the interruption mode Cooperative (IMCP) and



Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCP1	I	1.19	2.07	0.87	2.39*	60.19
DCP2	III	-1.45	-1.74	-0.77	2.26*	230.16
ICP1	I	13.29	11.54	0.66	17.61*	40.97
ICP2	I	4.63	2.05	0.40	5.07*	23.88
ICP3	III	-2.06	-2.15	-0.72	2.98*	226.34
DRM2	III	-4.38	-3.35	-0.61	5.51*	217.40
IRM1	III	-8.37	-8.19	-0.70	11.71*	224.35
IRM2	III	-1.38	-1.08	-0.62	1.75	218.11
IRM3	III	-0.43	-0.40	-0.68	0.58	223.15
IRM4	I	0.47	1.66	0.96	1.73	74.32
IRM5	III	-6.69	-5.11	-0.61	8.42*	217.34

Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCI1	III	-9.99	-12.99	-0.79	16.39*	232.44
DCI2	III	-2.72	-1.97	-0.59	3.35*	215.92
DCI3	III	-0.79	-0.79	-0.71	1.11	224.86
ICI1	I	3.62	3.91	0.73	5.33*	47.17
ICI2	I	0.38	1.48	0.97	1.53	75.62
ICI3	III	-7.74	-8.77	-0.75	11.70*	228.59
RI1	III	-2.30	-5.55	-0.92	6.01*	247.45
RI3	III	-4.81	-2.55	-0.47	5.44*	207.93

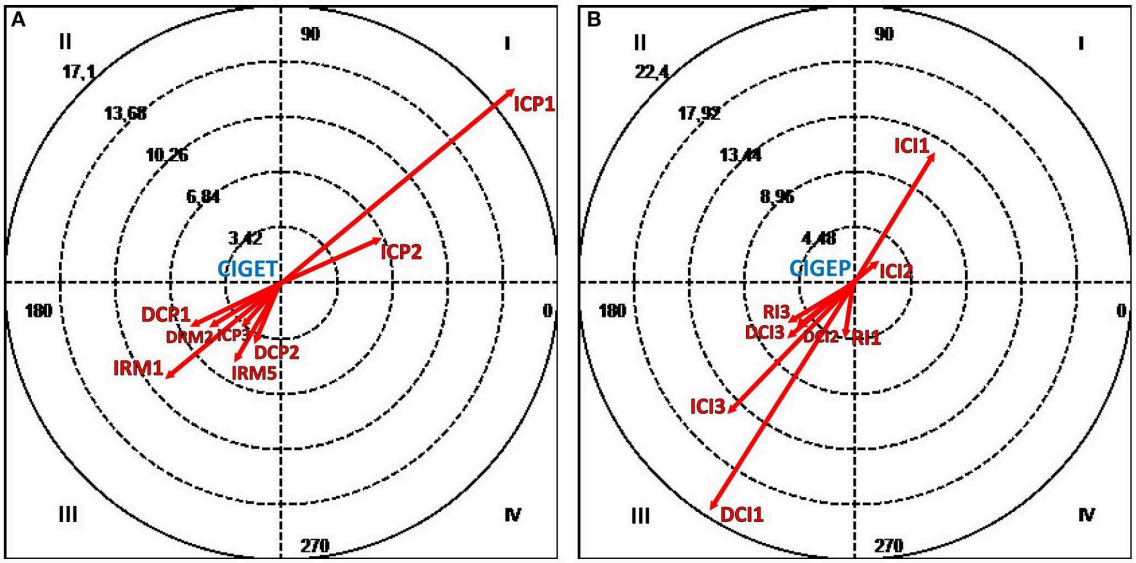
FIGURE 3 | Vectorial maps of the statistically significant relationships for the therapist **(A)**, considering the structural form Question (SF3T) as focal behavior and CIS-P categories [Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1) Affective Avoidance (IRM2), Self-esteem Regulation Strategies (IRM3), Indirect Allusions (IRM4), and Acquiescence (IRM5)] as conditional behaviors, and for the group of depressed patients **(B)**, considering the structural form Assertion (SF2P) as focal behavior and CIS-T categories [Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3)] as conditional behaviors. Under each map, the results of the polar coordinate analysis are presented. The significance level was fixed at $^*p < 0.05$.

therapist's collaborative interventions focused on the therapy goals and tasks (DCI1), the patients' feelings toward the therapy and/or the therapist (DCI2), and the meaning of patients' experiences (ICI3).

DISCUSSION

Our study aimed to analyze how specific verbal and non-verbal modes, implemented by the therapist and depressed patients, could influence and foster the reciprocal construction of a good TA, a relational and collaborative dimension that proved to be an active agent in the process of psychotherapy change (Colli and Lingiardi, 2009) during the mutual regulation processes emerging in the initial stages of therapy.

The findings presented propose a perspective of investigation on the psychotherapeutic exchange that emphasizes the importance of the joint action of *what* is said and *how* it is said, as an interacting system of verbal and non-verbal behaviors that acts by spreading information within a mutual regulation process between participants (Del Giacco et al., 2019). This notion of communication allows analyzing the therapeutic interaction by identifying those actions whereby both the therapist and the depressed patient participate in the TA construction and the verbal and non-verbal coordination processes. These aspects are at the basis of therapeutic change, as new ways for the patient to give meaning, interpret, and represent the inner reality and the surrounding world (Arístegui et al., 2004; Valdés and Krause, 2015). The results of the early TA study during the mutual regulation processes corroborate that the verbal and



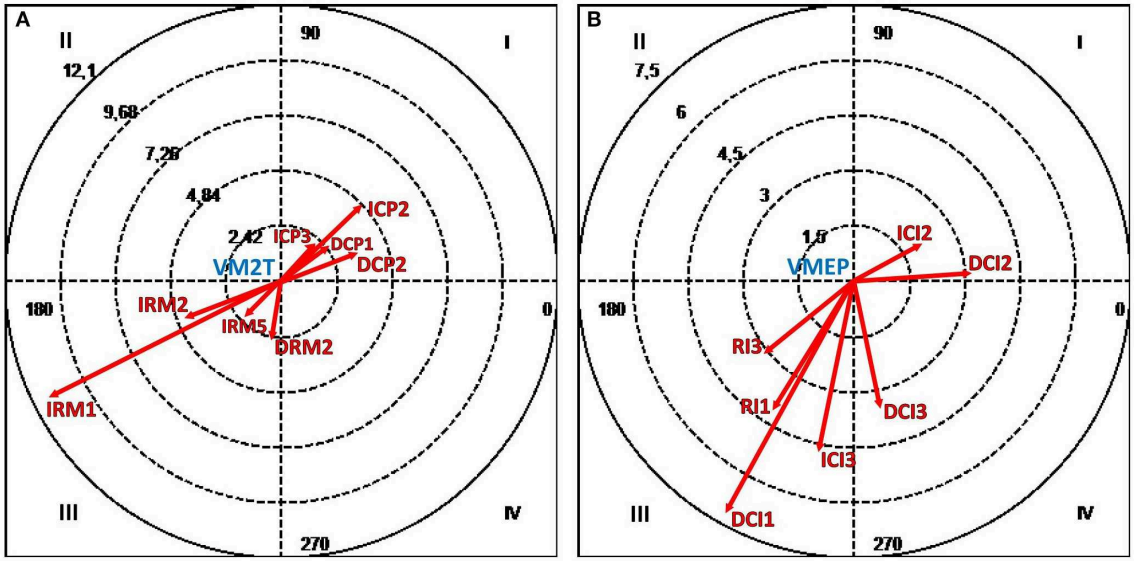
Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCP1	III	-5.41	-2.57	-0.43	5.99*	205.46
DCP2	III	-1.91	-3.65	-0.89	4.12*	242.45
ICP1	I	14.28	12.00	0.64	18.65*	40.04
ICP2	I	6.14	2.88	0.42	6.78*	25.14
ICP3	III	-2.55	-2.55	-0.71	3.60*	224.93
DRM2	III	-4.53	-2.48	-0.48	5.17*	208.70
IRM1	III	-7.18	-5.77	-0.63	9.21*	218.82
IRM2	III	-1.48	-0.11	-0.07	1.48	184.26
IRM3	III	-0.05	-0.05	-0.66	0.07	221.53
IRM4	I	0.96	0.42	0.40	1.05	23.40
IRM5	III	-2.73	-4.80	-0.87	5.52*	240.39

Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCI1	III	-11.69	-18.65	-0.85	22.01*	237.93
DCI2	III	-4.74	-3.83	-0.63	6.09*	218.91
DCI3	III	-5.48	-4.82	-0.66	7.29*	221.31
ICI1	I	6.68	10.34	0.84	12.31*	57.15
ICI2	I	1.71	1.47	0.65	2.26*	40.62
ICI3	III	-10.02	-10.39	-0.72	14.43*	226.04
RI1	III	-0.62	-4.64	-0.99	4.68*	262.39
RI3	III	-5.41	-3.41	-0.53	6.40*	212.21

FIGURE 4 | Vectorial maps of the statistically significant relationships for the therapist **(A)**, considering the communicative intent Global Exploration (CIGET) as focal behavior and CIS-P categories [Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1) Affective Avoidance (IRM2), Self-esteem Regulation Strategies (IRM3), Indirect Allusions (IRM4), and Acquiescence (IRM5)] as conditional behaviors, and for the group of depressed patients **(B)**, considering the communicative intent Global Exploration (CIGEP) as focal behavior and CIS-T categories [Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3)] as conditional behaviors. Under each map, polar coordinate analysis results are presented. The significance level was fixed at $^*p < 0.05$.

non-verbal behaviors of the therapist and depressed patients (who show difficulties in establishing and maintaining the TA because of their symptomatic characteristics) play a significant role in fostering collaborative behaviors that consolidate the therapeutic relationship in the initial stages of psychotherapy. All this confirms that the early TA lays the foundations for therapeutic change (Colli and Lingiardi, 2009; Ardito and Rabellino, 2011).

Concerning Verbal Mode-Structural Forms, the results confirm our hypothesis and corroborate the findings of Krause et al. (2016), according to which the therapist's structural form Question and the depressed patients' structural form Assertion foster the coordination between participants through collaborative behaviors. First of all, as in the study of Krause et al. (2016), we can notice that the therapist tends to ask more than depressed patients, while the latter tend to assert more than the former during the processes of TA building in the initial stages of psychotherapy. Of course, Verbal Mode-Structural Forms represent a surface characteristic of the communicative exchange between the therapist and patient; however, this result may provide information about the heterogeneity of the therapeutic process over time. According to Krause et al. (2016), these differences in using structural forms show the relational asymmetry between the therapist and patients where the roles are complementary: questions about the problems of the patient characterize the therapist's role, while assertions about their inner reality characterize patients. Moreover, this asymmetry is consistent with the idea of the initial phase of



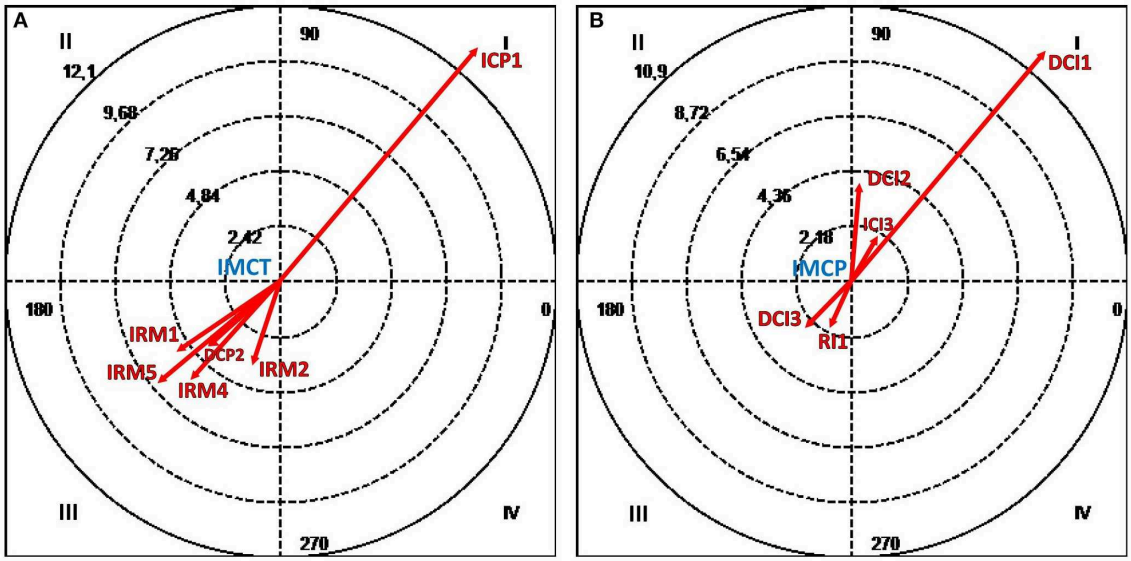
Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCP1	I	1.99	1.84	0.68	2.71*	42.78
DCP2	I	2.87	1.10	0.36	3.08*	20.92
ICP1	II	-0.02	1.03	1.00	1.03	91.34
ICP2	I	3.46	3.46	0.71	4.89*	45.01
ICP3	I	1.61	1.61	0.71	2.27*	45.01
DRM2	III	-0.35	-2.53	-0.99	2.55*	262.13
IRM1	III	-10.06	-5.01	-0.45	11.24*	206.49
IRM2	III	-4.24	-1.55	-0.34	4.52*	200.10
IRM3	I	1.22	1.22	0.71	1.72	45.01
IRM4	IV	1.82	-0.19	-0.10	1.83	354.06
IRM5	III	-1.71	-1.44	-0.64	2.23*	220.05

Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCI1	III	-3.45	-6.21	-0.87	7.10*	240.92
DCI2	I	3.11	0.18	0.06	3.12*	3.29
DCI3	IV	0.65	-3.34	-0.98	3.40*	281.09
ICI1	IV	1.32	-1.31	-0.70	1.86	315.25
ICI2	I	1.83	1.04	0.50	2.10*	29.68
ICI3	III	-0.98	-4.55	-0.98	4.65*	257.81
RI1	III	-2.11	-3.47	-0.85	4.06*	238.71
RI3	III	-2.39	-1.95	-0.63	3.09*	219.18

FIGURE 5 | Vectorial maps of the statistically significant relationships for the therapist **(A)**, considering the vocal mode Connected (VM2T) as focal behavior and CIS-P categories [Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1) Affective Avoidance (IRM2), Self-esteem Regulation Strategies (IRM3), Indirect Allusions (IRM4), and Acquiescence (IRM5)] as conditional behaviors, and for the group of depressed patients **(B)**, considering the vocal mode Emotional (VMEP) as focal behavior and CIS-T categories [Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3)] as conditional behaviors. Under each map, the results of the polar coordinate analysis are presented. The significance level was fixed at $^*p < 0.05$.

therapy as a moment of co-construction of the relationship and development of intersubjectivity, in which participants regulate each other according to the different verbal behaviors associated with their roles (Beebe et al., 2005). The studies of Krause et al. (2016) and Long (2001) emphasize that this asymmetry is reduced during the final stage of psychotherapy as if the former was preparatory to the latter. During this stage, indeed, both participants tend to affirm; moreover, the therapist performs actions aimed at making patients more responsible about the problem and its recovery to prepare them for the end of the therapy.

Our analyses show that the therapist's use of questions involves stable patterns and significant associations with collaborative processes by depressed patients, mainly related to the exploration of their experiences, emotions, and the goals of psychotherapy. Symmetrically, the depressed patients' use of assertions involves stable patterns and significant associations with collaborative interventions by the therapist on their experiences. Therefore, during the initial stages of psychotherapy, both questions of the therapist and assertions of depressed patients generate, together with the collaborative behaviors of the other, two self-sustaining systems that consolidate the therapeutic relationship within a mutual coordination process (Beebe, 2006). These behaviors are mainly at an experiential level for both participants and do not deepen the meaning of the internal representations of patients. Nevertheless, the use of questions stimulates depressed patients to give the therapist access to their emotional states related to these experiences and participate in the definition of therapeutic work. All this is consistent with the initial stage of psychotherapy when the therapist and patients are focused on



Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle	Category	Q	Prosp.	Retrosp.	Ratio	Radius	Angle
DCP1	III	-0.80	-1.04	-0.79	1.31	232.40	DCI1	I	7.74	9.10	0.76	11.95*	49.64
DCP2	III	-1.76	-1.52	-0.65	2.32*	220.82	DCI2	I	0.25	3.88	1.00	3.89*	86.31
ICP1	I	4.75	5.57	0.76	7.32*	49.53	DCI3	III	-1.77	-1.77	-0.71	2.50*	225.00
ICP2	I	0.80	0.14	0.17	0.82	9.61	ICI1	I	0.38	1.22	0.96	1.28	72.84
ICP3	I	1.28	1.46	0.75	1.94	48.61	ICI2	II	-0.86	1.42	0.85	1.66	121.25
DRM2	II	-0.39	1.57	0.97	1.62	103.79	ICI3	I	1.14	1.71	0.83	2.05*	56.35
IRM1	III	-2.55	-1.69	-0.55	3.06*	213.52	RI1	III	-0.90	-1.80	-0.89	2.01*	243.43
IRM2	III	-0.66	-2.02	-0.95	2.12*	251.96	RI3	II	-0.96	1.45	0.84	1.74	123.36
IRM3	IV	0.65	-0.62	-0.69	0.89	316.41							
IRM4	III	-2.25	-2.25	-0.71	3.18*	225.00							
IRM5	III	-2.95	-2.39	-0.63	3.79*	219.08							

FIGURE 6 | Vectorial maps of the statistically significant relationships for the therapist **(A)**, considering the interruption mode Cooperative (IMCT) as focal behavior and CIS-P categories [Direct Collaborative Processes on Negotiation Tasks/Goals (DCP1) and Affects (DCP2); Indirect Collaborative Processes on Facts (ICP1), Affects (ICP2), and Meaning (ICP3); Direct Rupture Markers on Relationship (DRM2); Indirect Rupture Markers as Linguistic Avoidance (IRM1) Affective Avoidance (IRM2), Self-esteem Regulation Strategies (IRM3), Indirect Allusions (IRM4), and Acquiescence (IRM5)] as conditional behaviors, and for the group of depressed patients **(B)**, considering the interruption mode Cooperative (IMCP) as focal behavior and CIS-T categories [Direct Collaborative Interventions on Task/Goal (DCI1), Affects (DCI2), and Meaning (DCI3); Indirect Therapist Interventions on Facts (ICI1), Affects (ICI2), and Meaning (ICI3); Rupture Interventions as Linguistic Avoidance (RI1) and Hostility (RI3)] as conditional behaviors. Under each map, the results of the polar coordinate analysis are presented. The significance level was fixed at $^*p < 0.05$.

laying the foundations of the therapeutic relationship (Safran and Muran, 2003). Thus, in clinical practice, the use of questions and assertions in the first stages of psychotherapy may promote collaborative behaviors that support the development and consolidation of a positive therapeutic relationship. Questions assume the function of a negotiating tool available to the therapist for the subsequent construction of new meanings. On the other hand, assertions become the expression of oneself and one's inner reality by depressed patients on which the therapist may act through his/her interventions for the construction of "new certainties" (Krause et al., 2016). We can conclude that questions and assertions, as regulatory strategies fostering the construction of a collaborative relationship, lay the foundations on which the therapeutic change rests and support its understanding.

Regarding Verbal Mode-Communicative Intents, the results confirm what we expected and are consistent with the findings of Dagnino et al. (2012), which underline that the therapist's and patients' intents of exploring (in our case the macro-category Global Exploration) affect the reciprocal coordination between participants through collaborative behaviors. As in the study of Dagnino et al. (2012), during the processes of building the TA, depressed patients use more global exploration (exploring, deepening, and focusing) than the therapist in the initial stages of psychotherapy. All this is consistent with the idea that the psychotherapy process requires an initial stage of inquiry and information exchange mainly focused on the exploration by patients (Dagnino et al., 2012).

As we can notice, the therapist's and depressed patients' global explorations involve similar stable patterns and significant

associations with the reciprocal collaborative behaviors of participants, focused on the events experienced by patients and their feelings about these experiences. The communicative intents of exploring, deepening, and focusing -which constitute the global exploration- show the complementary nature of verbal interactions and collaborative behaviors of participants, implemented through circular schemes that foster the coordination processes and the TA construction (Heatherington, 1988; Dagnino et al., 2012). All this allows the construction of a relational space that promotes collaborative behaviors aimed at the joint work of the therapist and the depressed patient on the problems of the latter who, however, is the primary agent for subjective change (Reyes et al., 2008; Dagnino et al., 2012). As Valdés et al. (2005) pointed out, these exploratory intents lay the foundations for the subsequent processes of resignification and therapeutic change. The collaborative behaviors related to experiences and emotions emerging in the initial stages of therapy could be considered as necessary precursors "to raise awareness of better cognitive or affective adaptive patterns" (Valdés and Krause, 2015, p. 115) and to encourage cognitive and behavioral changes in the subsequent phases of building new meanings (Goldman et al., 2005). In clinical practice, these results may provide the therapist with empirical support to develop and consolidate an appropriate collaborative relationship at the basis of resignification processes, where there is a mutual communicative and emotional adaptation between participants: this is possible by performing interventions aimed at self-and mutual regulation through the speech and by encouraging the depressed patient to explore.

Concerning Vocal Modes, the results confirm our hypothesis and support the findings of Tomicic et al. (2015b) where the therapist's vocal mode Connected and the patients' vocal mode Emotional play a significant role in the coordination processes between participants at the basis of the TA construction and psychotherapy change. In our study, it emerged that depressed patients show a greater elaborative and emotional vocal mode than the therapist during the coordination processes. Compared with the study of Tomicic et al. (2015b), where the latter expressed a more elaborative vocal quality than the former, our result could be interpreted as the effect of psychodynamic psychotherapy. Especially in the early stages, indeed, this approach stimulates depressed patients to connect with their inner world and to define the unresolved problems and unconscious feelings, creating a space of intervention that the therapist may access to work on them (Busch et al., 2007; Gabbard, 2018).

Nevertheless, our analyses show that the therapist's use of an elaborative vocal mode involves stable patterns and significant associations with depressed patients' collaborative processes on feelings related to their experiences and the therapy as well as on the therapy goals and the meaning of the events experienced. According to Tomicic and Martínez (2011), during the psychotherapeutic process, the occurrence of vocal modes is heterogeneous and assumes a U-shape where the elaborative vocal mode characterizes the initial stages. Considering voice as a tool for transmitting psychological meanings and emotional states among participants (Tomicic et al., 2011), this vocal mode of the therapist promotes the development of the inter-mental space (Martinez Guzman et al., 2014) that receives patients and stimulates the latter to implement collaborative behaviors focused on reworking their emotional states and inner representations. At the same time, this inter-mental space supports intersubjective processes in depressed patients, encouraging their contribution to define and consolidate the relationship and therapeutic work with the therapist through continuous circular processes (Wiseman and Rice, 1989). Similarly, from the depressed patients' use of emotional vocal mode, there are stable patterns and significant associations with the therapist's collaborative interventions on patients' feelings related to the therapy and their experiences and on the meaning of episodes occurring during a psychotherapy session. The emotional vocal mode, characterizing the whole therapeutic process (Tomicic and Martínez, 2011), affects the emotional climate of sessions and the development of TA (Bauer et al., 2010). Voice reflects the speaker's emotional state that "allows the listener an empathetic understanding of the speaker him/herself" (Tomicic et al., 2009, p. 36). Therefore, vocal expression of emotions by depressed patients stimulates the therapist to consolidate the affective syntony that emerges in the psychotherapeutic relationship and to rework the emotional experience of patients through circular and continuous patterns (Beebe, 2006; Orsucci et al., 2016). At the same time, this vocal mode expresses the depressed patients' openness to their inner states, encouraging the therapist to implement interventions aimed at identifying dysfunctional patterns. Thus, in clinical practice, elaborative and emotional vocal modes, intertwining with the verbal dimension of the therapeutic dialogue (Jones and LeBaron, 2002), may become psychotherapeutic tools that support the therapist in self-and mutual regulation processes with depressed patients (Tomicic et al., 2009), increasing the effectiveness of interventions to consolidate the therapeutic relationships and the deepest reworking processes that prepare for change.

Regarding Interruption Modes, the results confirm our hypothesis and, in agreement with Li et al. (2005), show that cooperative interruptions activate coordination processes between participants through circular schemes (Beebe, 2006), assuming a mediating role in the TA construction and, consequently, in psychotherapy change[1]. As in the study of Oka et al.[1], during the TA construction, the therapist implements more cooperative interruptions than depressed patients in the initial stages of psychotherapy. Within the therapeutic encounter, the relational asymmetry between patient and therapist implies that the latter is the one who has control of the conversational process (Fisher, 1984). Patients who ask for help recognize the therapist's position as an expert to rely on; the latter, therefore, has the professional power whereby he/she can interrupt to address the problems that the patient brings into the session (Stratford, 1998). Thus, the therapist's interruptions may assume collaborative potential when experienced by patients as "appropriate use of their expertise, to helpfully alter the direction or content of the therapeutic conversation" (Stratford, 1998, p. 388).

From our results, we can notice that the therapist's use of cooperative interruptions leads to stable patterns and significant associations with depressed patients' collaborative behaviors related to the events experienced. As we mentioned above, the initial stage of psychodynamic therapy represents a moment of acceptance and definition of the patient's problems in which the therapist guides the inquiry and, at the same time, leaves freedom of exploration to the former (Busch et al., 2007; Gabbard, 2018). During the therapeutic dialogue, the therapist invades the elaborative space of depressed patients with the intent of agreeing, supporting, and clarifying, that is implementing interruptions that, according to Ng et al. (1995) and Stratford (1998), promote the patients' exploratory behaviors and create an inter-mental space where participants develop and consolidate the therapeutic relationship (Martinez Guzman et al., 2014). On the other hand, from the depressed patients' use of cooperative interruptions, there are stable patterns and significant associations with the therapist's collaborative interventions on the therapy goals, patients' feelings related to the therapeutic relationship, and the meaning of their experiences. This result shows that, during the TA construction in the initial stages of therapy, depressed patients cooperatively interrupt to express involvement and participation in the therapeutic dialogue (Tannen, 1994; Cafaro et al., 2016), activating intersubjective processes that feed the inter-mental space with the therapist through continuous circular processes (Beebe, 2006; Martinez Guzman et al., 2014). This context allows the latter to implement collaborative interventions aimed, on the one hand, at consolidating the therapeutic relationship and work and, on the other hand, at promoting the redefinition of depressed patients' representations (Goldberg, 1990). In clinical practice, during the initial stages of psychotherapy, cooperative interruptions enrich the meaning and strength of the speech: they could be facilitators for the therapist and indicators of the depressed patients' involvement level. Therefore, the therapist may use these interruptions both to encourage the exploratory processes with the depressed patient and to orient the mutual coordination processes at the basis of the TA construction and psychotherapy change.

In support of our results and by way of example, the two following clinical vignettes (**Table 9**) show possible combinations of communicative behaviors for a good and a poor TA, respectively.

Clinical vignette 1 emphasizes what emerged so far and how the interaction of verbal and non-verbal communicative modes, analyzed in our study and implemented by the therapist and depressed patient, leads to the building of a good alliance and the consolidation of the therapeutic relationship. Clinical vignette 2, on the contrary, shows the series of communicative exchanges bringing to the rupture of TA due to the combination of some verbal and non-verbal modes by the therapist and patient that, according to the literature (Li et al., 2005; Dagnino et al., 2012; Tomicic et al., 2015b; Krause et al., 2016[1]), may negatively influence the processes of change and relational construction. In turn 106, the therapist tries to resignify the patient's experience by affirming with conviction a particular state of reality. However, the patient reacts by intrusively interrupting and denies with certainty by attacking the relationship with the therapist (turn 107). In turn, the therapist intrusively interrupts through a new resignification that affirms with conviction and hostility (turn 108). The patient replies by interrupting again in an intrusive way and affirms with conviction his inner reality by isolating affection (turn 109). It should be noted that, despite the patient's communicative intent of global exploration, the presence of declarative and intrusive modes intertwining with the verbal component affects the meaning of the speech emitted, hindering the process of change and bringing to the rupture of TA. Probably, since these are the initial stages of the therapy (the first three sessions), the attempt of resignification that the therapist affirms with conviction is too premature to be supported by the depressed patient, generating an escalation of conflictual ruptures between participants that deteriorate the TA.

The results obtained advance in understanding the verbal and non-verbal communication modes that foster the TA construction between therapist and depressed patients in the initial stages of psychodynamic psychotherapy. Precisely, the study provides a measure of those elements of communication that may sustain depressed patients to overcome the difficulties in accessing their inner world and emotions and in regulating their relational distance in interaction with the therapist (Valdés, 2014; Valdés and Krause, 2015). These represent typical aspects of the functioning profile of depressed patients that derive from the first cognitive-affective representations and impact on the development and maintenance of the TA (Levy and Wasserman, 2009; Balsters et al., 2012; Smirnova et al., 2018). We believe, therefore, that these results, on the one hand, may consolidate knowledge on verbal dynamics and, on the other hand, may reveal aspects unexplored in the Italian context on vocal and interruption modes that, together with the former, may guide interventions with this kind of patients to increase the therapeutic effectiveness and lay the foundations for change.

The observational methodology application, both through the integrative procedure of an *ad hoc* indirect observation instrument and an observation tool with deductive (or theoretical) categories and through the use of quantitative statistical analysis techniques, has proved effective in obtaining relevant information on the dynamics existing between patient and therapist. In particular, the complementary use of lag sequential analysis and polar coordinate analysis allows a rigorous, objective, and exhaustive evaluation of the reality of the therapeutic exchange (Anguera et al., 2018). In our study, these analyses were performed considering 10 retrospective lags (from lag-10 to lag-1) and 10 prospective lags (from lag+1 to lag+10), unlike the usual practice of including only five lags (Sackett, 1980). Given the type of subject, the purpose of the study, and the characteristics of participants, we made this choice to obtain a greater wealth of information from the complexity of the interactive dynamics between therapist and depressed patients. The mixed methods approach, which includes this methodology, has allowed observing the ecological context of the therapeutic exchange through objective measures increasing the knowledge on the processes related to the TA construction (Creswell and Plano Clark, 2017; Anguera et al., 2018).

TABLE 9 | Clinical vignettes.

Turn	Role	Transcription	VeM-SF	VeM-CI	VoM	IM	CIS-T	CIS-P
Clinical vignette 1								
180	T	How do you feel about talking about stuff like that again?	Question	Global Exploration	Connected	/	DCI on Affects	
181	P	It's strange… I'm not used to talking about my things, but I feel calm because it was something I wanted to do for me.	Assertion	Global Exploration	Emotional	/		DCP on Affects
182	T	Calm how? //(<2")	Question	Global Exploration	/	/	DCI on Affects	
183	P	//Well, you know, it's hard to have a dialogue with my mom without a figh-//	Assertion	Global Exploration	Emotional	Cooperative		ICP on Facts
184	T	//Do you feel anger growing with her too?	Question	Global Exploration	Connected	Cooperative	ICI on Affects	
185	P	Yes…I try to tell her what I have inside, but she doesn't listen to me and stays firm in her beliefs…so I start shouting...	Assertion	Global Exploration	Emotional	/		ICP on Facts
Clinical vignette 2								
106	T	It seems to me that you're behaving with your boyfriend the same way as you are with your fathe-//	Assertion	Resignifying	Declarative	/	ICI on Meaning	
107	P	//No, it's not like you're sayin-//	Denial	Global Exploration	Declarative	Intrusive		DRM on Relationship
108	T	//but, when you stop to put together the relationship you have with your boyfriend and that one with your father, you don't seem so sure anymore-//	Assertion	Resignifying	Declarative	Intrusive	RI of Hostility	
109	P	//My father was a person who disappeared for days, but you know how fathers are… they're always busy at work.	Assertion	Global Exploration	Declarative	Intrusive		IRM of Affective Avoidance

T, Therapist; P, Patient; VeM-SF, Verbal Mode-Structural Form; VeM-CI, Verbal Mode-Communicative Intent; VoM, Vocal Mode; IM, Interruption Mode; CIS-T, Collaborative Interactions Scale-Therapist; CIS-P, Collaborative Interactions Scale-Patient; DCI, Direct Collaborative Intervention, ICI, Indirect Collaborative Intervention; RI, Rupture Intervention; DCP, Direct Collaborative Process; ICP, Indirect Collaborative Process; DRM, Direct Ruptures Marker; IRM, Indirect Rupture Marker; /, indicates the not-coded behaviors; //, indicates the speaking turn interruption; (<2"), indicates a speech <2 s in duration.

However, this study is not exempt from limitations. The first one is related to the theoretical approach of psychotherapy. Our research only considered psychodynamic psychotherapy but, as a future objective, it would be interesting to extend the study of the dynamics between communication and TA building to other types of psychotherapeutic approaches (e.g., cognitive-behavioral therapy, systemic therapy) to investigate the potential precursors of change in each of them. Second, we only contemplated therapies conducted by the same female therapist; for future developments, it would be useful to include the study of psychotherapies with male therapists to assess the presence of gender differences in the indicators underlying the change. Third, we only analyzed the first three sessions of each psychotherapy, but it would be useful to extend the study to complete therapies to understand how the communicative modes influence the whole process and the psychotherapy outcome (e.g., by performing pre-post treatment studies), connected to change. Fourth, we observed 20 psychotherapy sessions (equivalent to 6,237 speaking turns); although it is an adequate number to collect a large amount of data and to detect hidden structures between constructs from the investigative perspective of the observational method (Anguera et al., 2017), it corresponds to the material produced by only seven patients from a clinical perspective. It would be useful to progressively increase the number of participants to extend the research and carry out further investigations such as the *multiple case study analysis* that allows detecting regularities between cases that are similar in some ways and homogeneous in the selection criteria (Stake, 2006). Fifth, our study focused on the interaction between communication and TA in patients with depressive symptoms. It could be interesting to extend the research to other types of disorders (e.g., anxiety, eating disorders, affective dysregulation) to trace behavioral patterns and significant associations related to change that are specific to each of them. Sixth, we focused on communication modes that have a positive impact on building a collaborative relationship between patient and therapist. However, it would be useful to extend the research by evaluating those indicators that may have a negative impact or hinder therapeutic change. Finally, our study took into account the processes of mutual regulation between

therapist and patient; however, it would be useful to deepen the self-regulatory processes to understand how they affect the internal organization of each participant during the construction of change.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The Psychology Interdepartmental Ethics Committee of the University of Padua (Italy) evaluated and approved this investigation. The study has been conducted following the ethical guidelines and procedures of the Interdepartmental Laboratories for Research and Applied Psychology (L.I.RI.P.A.C.), to which the DPS belongs, based on Italian law no. 196/03 about privacy and confidentiality and the ethical standards for research established by the American Psychological Association (2017). All participants gave their written informed consent to participate in the research in conformity with the Declaration of Helsinki before making the audio recording and data collection; the study was conducted after the end of psychotherapies. Personal information of participants was replaced and not provided to the coders of audio recordings and transcripts to guarantee confidentiality.

AUTHOR CONTRIBUTIONS

LD documented, designed, drafted, and wrote the manuscript. Moreover, he trained and supervised the coders and accomplished statistical analyses. SS supervised the sample recruitment, while MA supervised the method and procedure sessions and statistical analyses. SS and MA revised the manuscript for theoretical and intellectual content. Finally, all authors provided the final approval of the version to be published.

FUNDING

LD and MA gratefully acknowledge the support of a Spanish government subproject *Integration ways between qualitative and quantitative data, multiple case development, and synthesis review as main axis for an innovative future in physical activity and sports research* [PGC2018-098742-B-C31] (2019-2021) (Ministerio de Ciencia, Innovación y Universidades, Programa Estatal de Generación de Conocimiento y Fortalecimiento Científico y Tecnológico del Sistema I+D+i), that is part of the coordinated project *New approach of research in physical activity and sport from mixed methods perspective (NARPAS_MM)* [SPGC201800X098742CV0]. LD and MA also acknowledge the support of the University of Barcelona (Vice-rectorate for Doctorate and Research Promotion) funding they obtained. Finally, LD and SS acknowledge the grant support of the Department of Developmental and Socialization Psychology (University of Padua) annual project *Voice quality and development of the therapeutic alliance: A mixed method design with depressed patients* [DPSS2019-13, prot. no. 412/2019].

ACKNOWLEDGMENTS

We thank Drs. Vittorio Lingiardi, Antonello Colli, Daniela Gentile, and Valeria Condino for their permission to include the CIS-R scheme in our research. We thank Drs. Sonia Aragón, Daniel Lapresa, Javier Arana, MA, and Belén Garzón for the permission to use their depiction of polar coordinates' vector map. Moreover, we thank Martina Romito, Giulia Michelluzzi, Anna Storti, Giorgia Carlotto, Silvia Montaruli, Michele Contro, Andrea Allegro, and Elisa Barbolini for their support during the data collection stage. Finally, we thank the reviewers for their stimulating comments and suggestions.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.00234/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 29 April 2020
doi: 10.3389/fpsyg.2020.00845

Roles of Trait Mindfulness in Behavioral Activation Mechanism for Patients With Major Depressive Disorder

Koki Takagaki[1], Masaya Ito[2], Yoshitake Takebayashi[2,3], Shun Nakajima[2] and Masaru Horikoshi[2]*

[1] Health Service Center, Hiroshima University, Hiroshima, Japan, [2] National Center for Cognitive Behavior Therapy and Research, National Center of Neurology and Psychiatry, Tokyo, Japan, [3] Department of Health Risk Communication, School of Medicine, Fukushima Medical University, Fukushima, Japan

Behavioral activation and mindfulness have both been shown to engender improvement of functional impairment in patients with major depressive disorder. In behavioral activation, the practice of engaging with the direct experience of the present moment is central, especially when targeting avoidance. Consequently, mindfulness affects changes of avoidance in behavioral activation. This study was designed to assess exploratory relations among trait mindfulness, avoidance, and functional impairment in behavioral activation mechanism for depression. For 1042 participants with depression only or for depression with anxiety disorders, we used structural equation modeling to examine relations among trait mindfulness, avoidance, and functional impairment. Trait mindfulness non-reactivity, non-judging, and acting with awareness had a direct negative effect on avoidance. Trait mindfulness non-reactivity, trait non-judging, and trait acting with awareness had indirect negative effects on functional impairment. Results show that each trait mindfulness facet exhibited a distinct pattern of relations with avoidance and impairment.

Keywords: behavioral activation, depression, trait mindfulness, avoidance, impairment

OPEN ACCESS

Edited by:
Melissa Miléna De Smet, Ghent University, Belgium

Reviewed by:
Rosa Angela Fabio, University of Messina, Italy
Gianluca Serafini, San Martino Hospital (IRCCS), Italy

****Correspondence:***
Koki Takagaki
koki.takagaki@gmail.com;
koki-takagaki@hiroshima-u.ac.jp

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *04 December 2019*
Accepted: *06 April 2020*
Published: *29 April 2020*

Citation:
Takagaki K, Ito M, Takebayashi Y, Nakajima S and Horikoshi M (2020) Roles of Trait Mindfulness in Behavioral Activation Mechanism for Patients With Major Depressive Disorder. Front. Psychol. 11:845. doi: 10.3389/fpsyg.2020.00845

INTRODUCTION

Depression is a leading cause of absenteeism and reduced work productivity (Gilmour and Patten, 2007). Moreover, people with depression have an elevated risk of suicide (Pompili et al., 2012, 2013). Among the effective psychological treatments for depression, behavioral activation and mindfulness have been shown to engender improvement of functional impairment among patients with major depressive disorders (Dimidjian and Davis, 2009).

Psychotherapeutic approaches using mindfulness and behavioral activation, respectively, apparently target maladaptive psychological processes contributing to the maintenance of depression, such as engagement in avoidant behaviors (Dimidjian and Davis, 2009). Martell's behavioral activation model (Martell et al., 2001) includes specific emphasis on the role of avoidance

including avoidant behavior and rumination. In their model, which is consistent with traditional behavioral models, behavioral activation modifies a person's environment through behavior change, which in turn increases access to positively reinforcing events and activities (Manos et al., 2010). In behavioral activation, the practice of engaging with the direct experience of the present moment is central, especially when targeting avoidance (Martell et al., 2010). In fact, a report of an earlier study described that mindfulness is linked to improvement of emotional processes (Fabio and Towey, 2018). Mindfulness is a mental state characterized by non-judgmental awareness of a present moment experience (Baer et al., 2004). Mindfulness can be conceptualized as a trait characteristic or suite of related characteristics, including the ability to observe and attend to experiences, the ability to describe those experiences, the ability to focus attention on the present moment, and the ability to adopt a non-judgmental attitude toward experiences (Baer et al., 2004). Theoretically, the practice of mindfulness can engender the occurrence of adaptive behavioral activation by canceling avoidant behavior through non-judgmental awareness (Kanter et al., 2009). Therefore, in a behavioral activation model for depression, mindfulness is an important factor to change avoidance to alternative behavior.

In meta-analysis conducted for an earlier study, trait mindfulness was found to be positively correlated with emotion regulation, mental health perceived life satisfaction, workplace functioning and professional outcome (Mesmer-Magnus et al., 2017). In addition, mindfulness is correlated negatively with avoidance (Baer et al., 2004), rumination (Desrosiers et al., 2013), and daytime impairment (Black et al., 2015). Takagaki et al. (2013b) described avoidance as positively correlated with functional impairment in a behavioral activation model. Therefore, based on results of several earlier studies (Baer et al., 2004; Desrosiers et al., 2013; Takagaki et al., 2013b; Black et al., 2015; Mesmer-Magnus et al., 2017), we hypothesized the following: trait mindfulness is negatively related to avoidance and impairment (**Figure 1**). Moreover, avoidance is positively correlated with impairment. Although earlier reports have described relations among those factors, trait mindfulness includes five abilities: observing, describing, acting with awareness, non-judging, and non-reactivity (Baer et al., 2006; Sugiura et al., 2012). Furthermore, earlier reports have described that characteristics of each trait mindfulness differ (Baer et al., 2006; Sugiura et al., 2012). Trait mindfulness except for observing was found to be negatively related with depressive symptoms, but Brown et al. (2015) found observation to be positively related with depressive symptoms. Trait mindfulness aside from observation and describing are negatively related to rumination (Dundas et al., 2013). Curtiss et al. (2017) described that observing was positively related to depression symptoms and that non-reactivity was positively related to reappraisal. Additionally, Teismann et al. (2016) demonstrated that increased awareness of present-moment experiences is associated with reduced avoidance and impairment. However, there has been lack of evidence among five trait mindfulness, avoidance, and impairment in the behavioral activation model of depression. Although we hypothesized that trait mindfulness is negatively related to avoidance and impairment based on earlier studies (Baer et al., 2004; Desrosiers et al., 2013; Black et al., 2015; Mesmer-Magnus et al., 2017), whether five trait mindfulness (observing, describing, acting with awareness, non-judging, and non-reactivity) is related to avoidance and functional impairment has not yet been investigated in behavioral activation for depression (**Figure 2**). Therefore, the primary purpose of this study was to assess the relation among five trait mindfulness, avoidance, and functional impairment in depression.

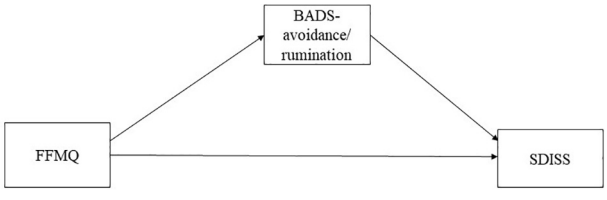

FIGURE 1 | Hypothetical model in the simple model FFMQ, Five Facet Mindfulness Questionnaire; BADS, Behavioral Activation for Depression Scale; SDISS, Sheehan Disability Scale.

MATERIALS AND METHODS

Participants and Procedures

This study is derived from a larger project for examining emotion and psychopathology. We obtained our data from results of a large web-based observational study (Ito et al., 2015). Details of the participants and procedures were presented in an earlier report. The sample of this study is same to previous study (Ito et al., 2015). In January and May 2014, 18-year-old or older panelists were recruited from those registered on Macromill Inc. Of the 1,095,443 registered panelists, 389,265 had been registered as "disease panelists." Anonymous participants with depression were asked if they were currently diagnosed and were using medical services for treatment because Macromill's operational definition of disease panelists had been reported by respondents 1 year before this study was conducted. We asked that are you currently diagnosed as having major depressive disorders (MDD) and being treated for the it in a medical setting? We posed the same questions for anxiety disorders (panic disorder, PD; social anxiety disorder, SAD; and obsessive–compulsive disorder, OCD). Participants were extracted randomly based on age, gender, and living area in each group. Furthermore, a report of an earlier study described that many participants' characteristics were that they were able to use the internet and were young people with low income. Detailed descriptions of the participants were presented elsewhere (Ito et al., 2015). At that time, 1042 participants met the criteria for depression only or for depression with anxiety disorders. Of them, 406 participants met the criteria for only MDD. Also, 636 participants met the criteria for comorbid MDD and any anxiety disorder (127, MDD and PD; 95, MDD and SAD; 100, MDD and OCD; 51, MDD, PD, and SAD; 52, MDD, PD, and OCD; 55, MDD, SAD, and OCD; 156, MDD, PD, SAD, and OCD). We used data of 1042 participants for statistical analyses.

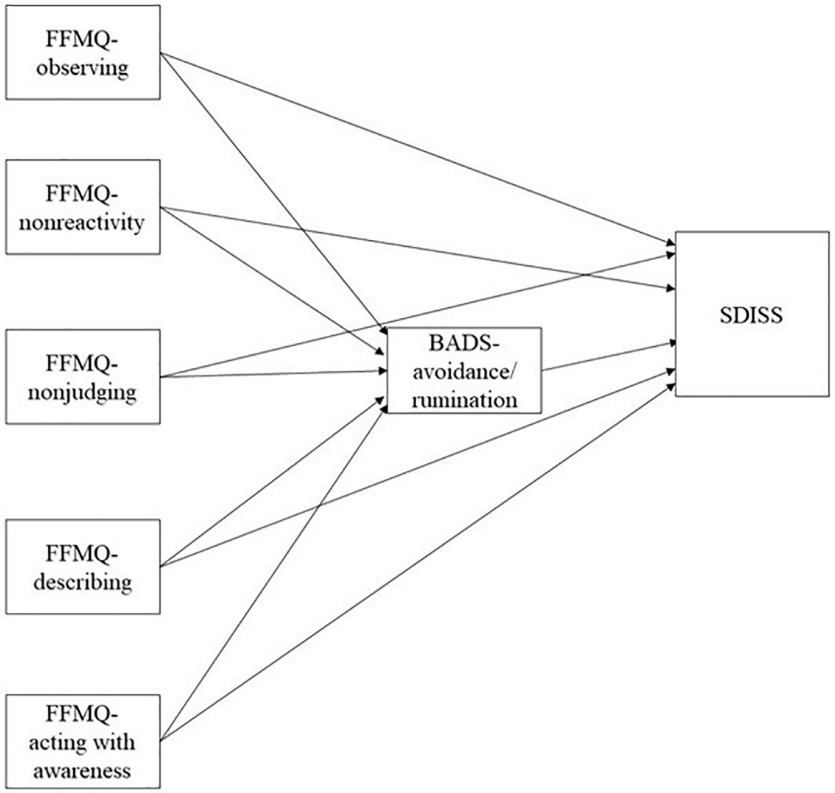

FIGURE 2 | Hypothetical model in the detailed model. FFMQ, Five Facet Mindfulness Questionnaire; BADS, Behavioral Activation for Depression Scale; SDISS, Sheehan Disability Scale.

Measures

Behavioral Activation for Depression Scale

The Japanese Behavioral Activation for Depression Scale (BADS), which comprises four subscales and 25 items. The four subscales include Activation (BADS-activation, BADS-AC), avoidance/Rumination (BADS-avoidance/rumination, BADS-AR), Work/School Impairment (BADS-work/school impairment, BADS-WS), and Social Impairment (BADS-social impairment, BADS-SI). The BADS-AC measures goal-directed activation and the completion of scheduled activities. The BADS-AR measures the avoidance of a negative aversive state, and engaging in rumination, rather than active problem solving. The BADS-WS measures the consequences of inactivity and passivity on work and school responsibilities. The BADS- SI measures similar social consequences and social isolation. BADS has good reliability and validity (Takagaki et al., 2013a). Cronbach alpha coefficients are adequate (BADS-A = 0.79, BADS-AR = 0.75, BADS-WS = 0.62, BADS-SI = 0.88, and BADS total = 0.78). This study specifically used BADS-AR. The avoidance/rumination subscale measures the avoidance of a negative aversive state and engagement in rumination rather than active problem-solving. We used a five-point Likert scale for each item to fit requirements of the larger web-based survey. A report of a study by Wakita et al. (2012) explained that descriptive statistics and reliability coefficients did not change significantly in accordance with response options. Confirmatory factor analysis results for the present sample showed acceptable fit to the data (CFI = 0.816, RMSEA = 0.098, SRMR = 0.083) in comparison to those of an earlier study (Kanter et al., 2007). Cronbach alpha coefficients were calculated for the four subscales (BADS-A = 0.82, BADS-AR = 0.84, BADS-WS = 0.78, BADS-SI = 0.91, and BADS total = 0.87).

Five Facet Mindfulness Questionnaire

The original Five Facet Mindfulness Questionnaire (FFMQ) comprises five subscales and 39 items, each of which is rated on a five-point Likert scale ranging from 1 (never or very rarely true) to 5 (very often or always true) (Baer et al., 2006). The five subscales include Observing (FFMQ-observing), Describing (FFMQ-describing), Acting with Awareness (FFMQ-acting with awareness), Non-judging (FFMQ-non-judging), and Non-reactivity (FFMQ-non-reactivity). The FFMQ-observing measure is applicable to internal or external environments. The FFMQ-describing measure can label the internal environment. The FFMQ-acting with awareness measure is applicable to the present moment. The FFMQ-non-judging measure does not allow to evaluate the internal environment. The FFMQ-non-reactivity measure is applicable to the internal environment without negative rumination. The Japanese version of the FFMQ has good reliability and

validity (Sugiura et al., 2012). Cronbach alpha coefficients are adequate (FFMQ-observing = 0.79, FFMQ-describing = 0.75, FFMQ-acting with awareness = 0.62, FFMQ-non-judging = 0.88, FFMQ-non-reactivity = 0.78, and FFMQ-Total = 0.80). Cronbach alpha coefficients in this study were calculated for five subscales (FFMQ-observing = 0.81, FFMQ-describing = 0.84, FFMQ-acting with awareness = 0.85, FFMQ-non-judging = 0.85 and FFMQ-non-reactivity = 0.79. FFMQ-Total = 0. 78).

Sheehan Disability Scale

The Japanese Sheehan Disability Scale (SDISS), which comprises 1 factor and 3 items, has good reliability and validity (Yoshida et al., 2004). The SDISS is used to measure disability. Cronbach alpha coefficients are.84–0.87. The three items include impairment of work/school, social life, and family life/home responsibilities. We used a five-point Likert scale for each item to fit requirements of the larger web-based survey. Therefore, we conducted confirmatory factor analysis. Confirmatory factor analysis results for the present sample showed acceptable fit to data (CFI = 1.00, RMSEA = 0.00, SRMR = 0.00). The Cronbach alpha coefficient in this study was.92.

Patient Health Questionnaire (PHQ-9)

The Japanese version of the Patient Health Questionnaire (PHQ-9) comprises nine items. PHQ-9 is used to measure depressive symptoms. PHQ-9 has good reliability and validity (Muramatsu et al., 2007). The Cronbach alpha coefficient is 93. Cronbach alpha coefficients in this study was 92.

Statistical Analysis

We conducted normality tests. However, not all factors had normality. We first report descriptive data. Next, we conducted analysis using Spearman correlation to examine relations among all factors. Results of an earlier study suggested that the bootstrap approach assumes that the sampling distributions of the total are normal when the underlying distribution is non-normal (Preacher and Hayes, 2008). Therefore, we examined relations among trait mindfulness, avoidance, and functional impairment using structural equation modeling (SEM) based on the maximum likelihood estimation method using bootstrapping.

We subsequently conducted an examination of the models including all variables. All observed variables were constructed using total scores. Several fit indices show how well the tested model accounts for the observed correlation structure of the data. The following indices were used for this study: chi-square test, comparative fit index (CFI), standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). The range of fit index values is 0–1 (Hooper et al., 2008). Reasonable fit is indicated by CFI values of 0.9 or more (Hooper et al., 2008). The RMSEA and SRMR lower limits are close to 0. Although the upper limit is expected to be less than 0.08, an RMSEA of 0.05–0.10 is regarded as an indication of fair fit (Hooper et al., 2008). The SRMR lower limit is close to 0, whereas the upper limit is expected to be less than 0.08 (Hooper et al., 2008). We used software for analyses (SPSS ver. 22.0; IBM Corp., Tokyo, Japan and Mplus ver. 7.4; Muthen & Muthen, Los Angeles, United States).

RESULTS

Participant Characteristics and Correlations

Of participants, 1042 (549 women, 493 men; mean age 42.66 ± 9.22) reported that they are currently obtaining treatment for depression with anxiety or for depression only. Correlation analysis was applied to explore associations among all factors (**Table 1**).

Structural Equation Modeling

We examined relations among trait mindfulness, avoidance, and functional impairment using SEM based on maximum likelihood estimation method using bootstrapping. Fitted index values suggested that the proposed model was valid ($\chi 2$ (3) = 534.96, $p < 0.00$, CFI = 1.00, RMSEA = 0.00, SRMR = 0.00; **Figure 3**). FFMQ-Total (standardized direct effect, −0.15; 95% confidence intervals, −0.18 to −0.13) had direct effects on BADS-AR. FFMQ-Total (standardized direct effect, −0.04; 95% confidence intervals, −0.06 to −0.03), and BADS-AR (standardized direct effect, 0.26; 95% confidence intervals, 0.23–0.28) had direct effects on SDISS. FFMQ-Total (standardized indirect effect, −0.04; 95% confidence intervals, −0.05 to −0.03) had indirect effects on SDISS. Next, we examined relations among five trait mindfulness, avoidance, and functional impairment using SEM based on with the maximum likelihood estimation method using bootstrapping. Fit index values suggested that the proposed model was valid ($\chi 2$ (11) = 833.39, p < 0.00, CFI = 1.00, RMSEA = 0.00, SRMR = 0.00; **Figure 4**). FFMQ-observing (standardized direct effect, 0.20; 95% confidence intervals, 0.12–0.28), FFMQ-non-reactivity (standardized direct effect, −0.28; 95% confidence intervals, −0.39 to −0.19), FFMQ-non-judging (standardized direct effect, −0.21; 95% confidence intervals, −0.28 to −0.13), and FFMQ-acting with awareness (standardized direct effect, −0.36; 95% confidence intervals, −0.44 to −0.27) had direct effects on BADS-AR. Moreover, FFMQ-observing (standardized direct effect, 0.08; 95% confidence intervals, 0.04 to 0.13), FFMQ-non-reactivity (standardized direct effect, −0.17; 95% confidence intervals, −0.21 to −0.13), FFMQ-acting with awareness (standardized direct effect, −0.05; 95% confidence intervals, −0.09 to −0.01), and BADS-AR (standardized direct effect,0.22; 95% confidence intervals, 0.19 to 0.26) had direct effects on SDISS. Moreover, results demonstrated that FFMQ-observing (standardized indirect effect, 0.04; 95% confidence intervals, 0.03 to 0.06), FFMQ-non-reactivity (standardized indirect effect, −0.06; 95% confidence intervals, −0.09 to −0.04), FFMQ-non-judging (standardized indirect effect, −0.05; 95% confidence intervals, −0.07 to −0.03), and FFMQ-acting with awareness (standardized indirect effect, −0.08; 95% confidence intervals, −0.10 to −0.06) had indirect effects on SDISS. FFMQ-describing was unrelated to BADS-AR and SDISS.

DISCUSSION

The primary purpose of this study was to assess the relation among five trait mindfulness, avoidance, and functional

TABLE 1 | Descriptive data in depression.

	Mean (SD)	PHQ-9	BADS-AR	FFMO-observing	FFMQ-non-reactivity	FFMQ-non-judging	FFMQ-describing	FFMQ-acting with awareness
PHQ-9	14.52 (7.53)							
BADS-AR	13.48 (7.34)	0.57**						
FFMO- observing	21.57 (6.07)	0.26**	0.33**					
FFMQ-non-reactivity	17.10 (4.83)	−0.27**	−0.10**	−0.29**				
FFMQ-non-judging	24.13 (6.44)	−0.36**	−0.40**	−0.52**	−0.06*			
FFMQ-describing	20.87 (6.27)	−0.29**	−0.13**	−0.16**	0.44**	0.07*	–	–
FFMQ-acting with awareness	25.18 (6.23)	−0.45**	−0.44**	−0.41**	−0.06	0.48**	0.25**	
SDISS	5.88 (3.69)	0.68**	0.56**	0.27**	−0.22**	−0.31**	−0.19**	−0.34**

*PHQ-9, Patient Health Questionnaire-9; BADS-AR, Behavioral Activation for Depression Scale-Avoidance/Rumination; The Five Facet Mindfulness Questionnaire-observing, FFMO- observing; FFMQ-non-reactivity, The Five Facet Mindfulness Questionnaire-non-reactivity; FFMQ-non-judging, The Five Facet Mindfulness Questionnaire-non-judging; FFMQ-describing, The Five Facet Mindfulness Questionnaire-describing; FFMQ-acting with awareness, The Five Facet Mindfulness Questionnaire-acting with awareness; SDISS, Sheehan Disability Scale. **p > 0.01, *p > 0.05.*

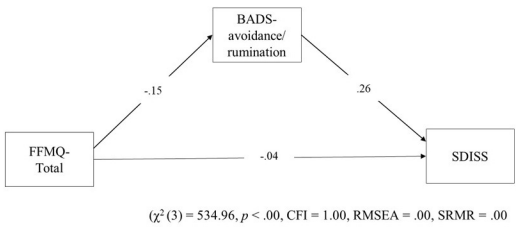

FIGURE 3 | Hypothetical model in the simple model. FFMQ, Five Facet Mindfulness Questionnaire; BADS, Behavioral Activation for Depression Scale; SDISS, Sheehan Disability Scale; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

impairment in depression. The results of this study that trait mindfulness non-reactivity, non-judging, and acting with awareness had a direct negative effect on avoidance. Trait mindfulness non-reactivity, trait non-judging, and trait acting with awareness had indirect negative effects on functional impairment. The results found for SEM showed that each trait mindfulness facet showed a distinct pattern of relations with avoidant behavior and functional impairment. Results of this study demonstrate the differential pathways of mindfulness facets to functional impairment via avoidance. Behavioral activation targets avoidance as a primary difficulty posed by depression (Martell et al., 2001). Acting with awareness is related to efficient attention and cognitive control, whereas non-reactivity is related to metacognitive skills involving suspension of worry in the face of negative thoughts (Sugiura et al., 2012). Moreover, non-judging should be related to enhanced cognitive decentering (Sugiura et al., 2012). Ferster (1973) reported that many activities of depressed individuals are characterized by avoidance of aversive experiences. In behavioral activation therapy, treatment involves collaboration between the therapist and client to emphasize assessment of behavioral patterns that maintain depressive symptoms, and to increase activation of rewarding behaviors and effective problem solving (Martell et al., 2001). Avoidant behaviors function to alleviate participants' distress in the short term, but they also increase depressive symptoms in the long term. Therefore, it is important to modify behaviors to achieve a long-term perspective. In enhancing the skills of acting with awareness, non-reactivity, and non-judging, results of our study indicate that individuals would be encouraged to modify negative cognitions related to specific experiences. They might be able to work on closely attending to specific behaviors, and might endeavor to foster an ability to activate helpful behaviors in the presence of negative affect. These skills would contribute to modification of avoidant behaviors to achieve a long-term perspective. A report of an earlier study described that the skills of acting with awareness, non-reactivity, and non-judging were improved by mindfulness-based interventions (van Emmerik et al., 2018). However, in this study, we were unable to examine the effectiveness that these skills affect modification of avoidant behaviors. Future studies must examine whether some exercises of mindfulness affect the skills of acting with awareness, non-reactivity, and non-judging in experimental research. The interesting results of this study show a deleterious effect of mindfulness observing impairment via avoidance. Observing was positively related to depression symptoms and anxiety symptoms (Brown et al., 2015; Curtiss et al., 2017). In addition, results of an earlier study suggest that observing appears to capture monitoring of experiences with reduced clarity, increased evaluation, and increased emotional distress (Sugiura et al., 2012). Avoidance is behavior that avoids negative aversive states. Therefore, increasing observation increases avoidance. Moreover, results of this study suggest that observation works to increase avoidance. Consequently, the implication is that one might decrease avoidance by decreasing observation.

This study has several limitations. The first limitation is participant selection. Participants were recruited via an internet survey, which can involve selection bias. To reduce the risk of bias, participants were recruited from various areas and age ranges. Because this was a web-based survey, it was limited to web users and biased to those who use the web frequently and to those who for whatever reason chose to complete a web-based survey. Even if one assumes that inclusion of

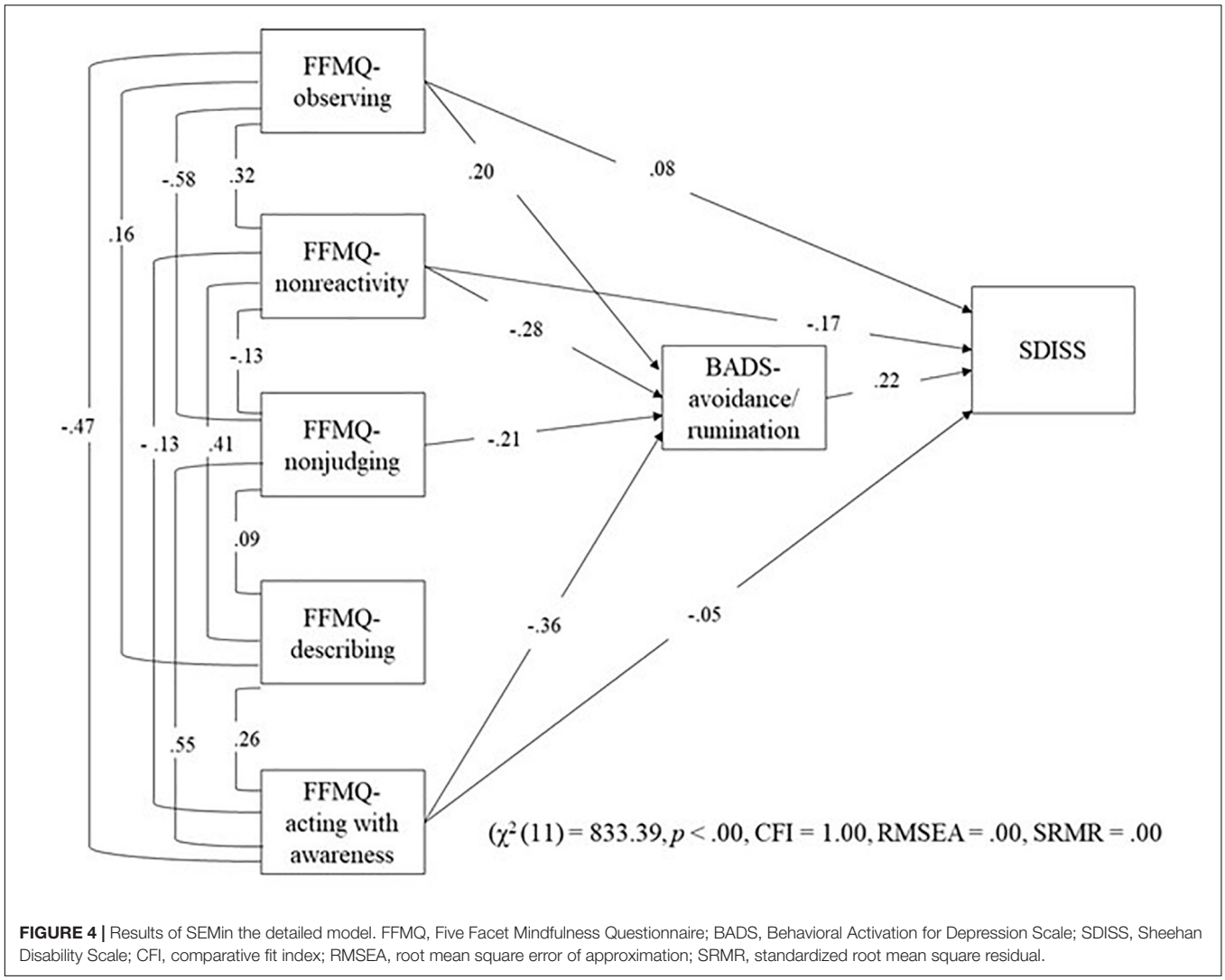

FIGURE 4 | Results of SEMin the detailed model. FFMQ, Five Facet Mindfulness Questionnaire; BADS, Behavioral Activation for Depression Scale; SDISS, Sheehan Disability Scale; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

people from multiple age groups and locations reduces this risk, it does not eliminate the risk and certainly does not allow generalization to non-web users and infrequent web users or to people who use the web but who choose not to fill out a form. Therefore, it is difficult to say how representative such a population might be of a clinical population or those coming to treatment for depressive illness. Moreover, many participants' characteristics were that many study participants' characteristics indicated they were young people with low income and ability to use the internet (Ito et al., 2015). In future research, it might be necessary to investigate this subject with only a clinical population or people seeking treatment for depressive illness. Secondly, we did not conduct a structured interview for assessing mental disorders. Additional studies must be conducted to generalize the results of this study using such a structured interview. Thirdly, we asked participants if they, at the time, were diagnosed as having MDD, PD, SAD, or OCD or were using medical services for treatment. However, we did not conduct structured interviews to assess mental disorders. Moreover, we did not check detailed information about somatic symptoms, medication, or psychotherapy. Also, although we did not check education or intelligence for this study, these factors are important to elucidate characteristics of the participants. Future studies should investigate these factors. Fourthly, we did not conduct an intervention in the earlier study. We conducted analyses by application of SEM to the relations among mindfulness, avoidance, and impairment in a process study. Therefore, interpretation of the possible causal relations must be done cautiously. Future studies should be conducted to investigate the causal relations using an appropriate experimental design. Fifth, only 406 participants met the criteria for only MDD, whereas 636 participants met the criteria for comorbid MDD and some anxiety disorder. The sample recruited for this study showed heterogeneous characteristics. Future studies should be conducted to analyze only the MDD sample. Finally, for this study, we hypothesized the following based on reports of some earlier studies: trait mindfulness is negatively related to avoidance and impairment. Furthermore, we examined relations among five trait mindfulness, avoidance, and functional impairment using structural equation modeling (SEM). However, it is

possible that the discouragement and frustration resulting from functional impairment produce the psychological mindfulness impairments. Future studies must be conducted to examine relations among psychological mindfulness, avoidance, and functional impairment. In addition, this research is a cross-sectional study. Future studies must be conducted to examine causation of some factors by a longitudinal study or clinical trial. Despite these limitations, results of this study reveal robust relations of trait mindfulness in behavioral activation mechanisms. This report is the first describing a study examining relations between trait mindfulness, avoidance, and impairment. Each facet of trait mindfulness showed different relations with avoidant behavior.

For enhancing the skills of acting with awareness, non-reactivity, and non-judging, patients diagnosed with MDD or MDD and anxiety would be encouraged to modify negative cognitions related to specific experiences. They might improve their abilities to attend to specific behaviors and to activate helpful behaviors even in the presence of negative affect.

DATA AVAILABILITY STATEMENT

The datasets generated for this study will not be made publicly available as the authors do not have permission to share the data. Any questions regarding the data in this study should be directed to the corresponding author.

ETHICS STATEMENT

The institutional review board at the National Center of Neurology and Psychiatry approved the ethical and scientific validity of this study (approval number: A2013-022). The survey was conducted on the Internet. Participants were asked to read the explanation of the study and provided informed consent by clicking the button of agreement before responding to questionnaires. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee.

AUTHOR CONTRIBUTIONS

KT, MI, YT, and SN conceived and designed the experiments. KT, MI, YT, SN, and MH contributed to the writing of the manuscript. All authors have approved the final manuscript.

FUNDING

This study was supported by a Grant-in-Aid for Research Activity start-up (24830127) from the Japan Society for the Promotion of Science, National Center of Neurology and Psychiatry Intramural Research Grant (24–4) for Neurological and Psychiatric Disorders. Furthermore, this work was supported by JSPS KAKENHI Grant Numbers 15K17307, 19K14449 and National Center of Neurology and Psychiatry Intramural Research Grant (27–3) for Neurological and Psychiatric Disorders.

ACKNOWLEDGMENTS

The authors would like to thank the participants.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 20 May 2020
doi: 10.3389/fpsyg.2020.00788

What Differentiates Poor- and Good-Outcome Psychotherapy? A Statistical-Mechanics-Inspired Approach to Psychotherapy Research, Part Two: Network Analyses

Giulio de Felice[1,2], Alessandro Giuliani[3], Omar C. G. Gelo[4,5], Erhard Mergenthaler[6], Melissa M. De Smet[7], Reitske Meganck[7], Giulia Paoloni[1], Silvia Andreassi[1], Guenter K. Schiepek[8], Andrea Scozzari[9] and Franco F. Orsucci[2,10]*

[1] Department of Dynamic and Clinical Psychology, Sapienza University of Rome, Rome, Italy, [2] Department of Psychology, NCIUL University, London, United Kingdom, [3] Istituto Superiore di Sanità (ISS), Rome, Italy, [4] Department of History, Society and Human Studies, University of Salento, Lecce, Italy, [5] Faculty of Psychotherapy Science, Sigmund Freud University, Vienna, Austria, [6] Clinic of Psychosomatic Medicine and Psychotherapy, Ulm University, Ulm, Germany, [7] Department of Psychoanalysis and Clinical Consulting, Ghent University, Ghent, Belgium, [8] Paracelsus Medical University, Salzburg, Austria, [9] Faculty of Economics, Niccolò Cusano University, Rome, Italy, [10] Psychoanalysis Unit, UCL University of London, London, United Kingdom

OPEN ACCESS

Edited by:
Gianluca Castelnuovo, Catholic University of the Sacred Heart, Italy

Reviewed by:
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Federica Biassoni, Catholic University of the Sacred Heart, Italy

***Correspondence:**
Giulio de Felice
giulio.defelice@uniroma1.it

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *16 October 2019*
Accepted: *31 March 2020*
Published: *20 May 2020*

Citation:
de Felice G, Giuliani A, Gelo OCG, Mergenthaler E, De Smet MM, Meganck R, Paoloni G, Andreassi S, Schiepek GK, Scozzari A and Orsucci FF (2020) What Differentiates Poor- and Good-Outcome Psychotherapy? A Statistical-Mechanics-Inspired Approach to Psychotherapy Research, Part Two: Network Analyses. Front. Psychol. 11:788. doi: 10.3389/fpsyg.2020.00788

Statistical mechanics is the field of physics focusing on the prediction of the behavior of a given system by means of statistical properties of ensembles of its microscopic elements. The authors examined the possibility of applying such an approach to psychotherapy research with the aim of investigating (a) the possibility of predicting good and poor outcomes of psychotherapy on the sole basis of the correlation pattern among their descriptors and (b) the analogies and differences between the processes of good- and poor-outcome cases. This work extends the results reported in a previous paper and is based on higher-order statistics stemming from a complex network approach. Four good-outcome and four poor-outcome brief psychotherapies were recorded, and transcripts of the sessions were coded according to Mergenthaler's Therapeutic Cycle Model (TCM), i.e., in terms of abstract language, positive emotional language, and negative emotional language. The relative frequencies of the three vocabularies in each word-block of 150 words were investigated and compared in order to understand similarities and peculiarities between poor-outcome and good-outcome cases. Network analyses were performed by means of a cluster analysis over the sequence of TCM categories. The network analyses revealed that the linguistic patterns of the four good-outcome and four poor-outcome cases were grounded on a very similar dynamic process substantially dependent on the relative frequency of the states in which the transition started and ended ("random-walk-like behavior", adjusted $R^2 = 0.729$, $p < 0.001$). Furthermore, the psychotherapy processes revealed statistically significant changes in the relative occurrence of visited states between the beginning and the end of therapy, thus pointing to the non-stationarity of the analyzed processes. The present study showed not only how to quantitatively describe psychotherapy as a network, but also found out the main principles on which its evolution is based. The mind, from a linguistic perspective, seems to work-through psychotherapy sessions by passing from

the most adjacent states and the most occurring ones. This finding can represent a fertile ground to rethink pivotal clinical concepts such as the timing of an interpretation or a comment, the clinical issue to address within a given session, and the general task of a psychotherapist: from someone who delivers a given technique toward a consultant promoting the flexibility of the clinical field and, thus, of the patient's mind.

Keywords: psychotherapy, complex systems, statistical mechanics, process of change, non-linear dynamics

INTRODUCTION

In the history of science, many efforts have been made to identify coarse-grained descriptors that can explain the behavior of complex systems composed of several different elements. Statistical mechanics describes physical phenomena in terms of the stochastic (random) behavior of a large numbers of components, such as atoms or molecules, focusing on the distribution of energy among these components. As such, statistical mechanics provides exact methods to connect thermodynamic quantities (e.g., pressure, volume, and temperature) to microscopic behavior (e.g., the behavior of a large number of atoms of a given gas). The importance of statistical mechanics resides in the development of coarse-grained statistical descriptors able to catch the essential features of a system regardless of its microscopic behavior. A crucial concept in this approach is the notion of "ensemble": an abstraction consisting of a large number of virtual copies (sometimes "infinitely many") of a system, considered all at once, each of which represents a possible state that the real system might occupy in a given instant of time (Hill, 1986). In other words, it is a collection of a large number of systems that are macroscopically identical (e.g., the isothermal–isobaric ensemble groups together the processes of the systems in which temperature and pressure are constant). Hence, statistical mechanics investigates the possibility to extract few relevant "macroscopic" features of a physical system described as "average quantities." In so doing, the discipline has always emphasized the importance of examining the instances in which complex processes undergo a drastic simplification as it allows for the characterization of the system as a whole in terms of few "order parameters" (here, avoiding the penumbra of associations around this technical word used in the domain of statistical mechanics, we will use the term "macro-parameters").

In the present study, we rely on the rationale of statistical mechanics, fostering its application to psychotherapy research in order to examine the possibility to reduce the complexity of the psychotherapeutic system into few coarse-grained empirical macro-parameters. From a clinical perspective, this effort of abstraction constituted the main objective of the entire work by Wilfred R. Bion, who is, according to the mainstream, the most important psychoanalyst of the modern era. In "Elements of Psychoanalysis", the author abstracts and describes the functioning of the three main elements of the mind, namely, the oscillation between the schizo-paranoid and depressive position (PS-D), the container–contained interaction (♀♂), and the linkages L–H–K (Bion, 1984). From an empirical perspective, the need for reducing the complexity of the psychotherapeutic system into few coarse-grained macro-parameters is justified by the continuously increasing number of identified single- and multiple-outcome predictors (de Felice et al., 2019a). In a recent systematic review on the outcome of cognitive–behavioral therapy for eating disorders, for instance, Linardon et al. (2017) found 6 mediators, 13 moderators, and 20 predictors while considering only patient characteristics (i.e., excluding any relational or therapist-related variables); also, no other forms of therapies or diagnoses were included in the review.

In the field of biology, many studies (e.g., Jolliffe and Cadima, 2016; Mojtahedi et al., 2016; Pagani et al., 2016; Giuliani et al., 2018) demonstrated the substantial usefulness of looking at biological systems from the perspective of statistical mechanics. In particular, it allowed one to reduce the hyper-complexity underlying a given phenomenon by focusing on the mutual correlations among system descriptors. This lens for observing the complexity underlying a given phenomenon, in biology, has been called the "middle-out" approach, since it focuses on the correlation among intervening variables (i.e., not "microscopic" raw variables, but macro-parameters calculated over their interactions), and lies between the hyper-complexity and hyper-simplification of the phenomenon under consideration. This approach has enabled researchers to describe complex biological systems through few macro-parameters mainly linked to changes in the degree of correlation of the system at hand (e.g., Laughlin et al., 2000; Giuliani et al., 2014).

Along these lines of thought, highlighting the importance of abstracting few macro-parameters to study the complexity of a given system, in the psychotherapy research literature, Schiepek and Strunk (2010) formulated an empirical dynamic descriptor that can predict therapeutic change and showed to be linked with good outcome. The descriptor, called "dynamic complexity" (indicated with "C"), was obtained by the multiplication of the distribution (D) and fluctuation (F) of a given variable ($C = D \times F$; for a detailed description, see Schiepek and Strunk, 2010); it can be used as a measure of the complexity of a system. Specifically, a peak of dynamic complexity has been found to precede therapeutic change, consistent with the statistical mechanics' theory of "tipping points" preceding critical transitions (Scheffer et al., 2012). The clinical counterpart of a "tipping point", and thus "a peak of dynamic complexity", can be the observation of something new occurring in the patient's in-session narratives (e.g., an insight) or in some of his/her behaviors outside the clinical room (e.g., see photographs of childhood or be interested in previously insignificant things) (e.g., Gumz et al., 2010, 2012). Other similar applications based on dynamic systems are described in previous works

(see Guastello et al., 2009; Pincus and Guastello, 2013; Gelo and Salvatore, 2016). Moreover, there are empirical studies that described psychotherapeutic processes in terms of stable dynamic patterns are worth mentioning (see Gelo et al., 2008; Tschacher and Ramseyer, 2009). In these works, initial attempts have been made to investigate the evolution of psychotherapy using coarse-grained empirical indices. However, despite these initial efforts, a fully consistent empirical proof of the possibility to predict the evolution of psychotherapy by means of quantitative macro-parameters of order, variability, and complexity has never been obtained. In this study, we aim to define a self-consistent procedure to compare psychotherapies with different orientations and different outcomes considering only the correlation pattern among their macro-parameters. Specifically, the primary and secondary research objective guiding the research project are (a) the possibility of predicting good- and poor-outcome psychotherapies on the sole basis of the correlation pattern among their macro-parameters, and (b) the investigation, in terms of those correlation patterns, of analogies and differences between the processes of good- and poor-outcome cases.

The first two steps of this investigation were examined in a previous work using the same dataset (see de Felice et al., 2019b); this study led to the following results:

1. By means of "static analyses" we were able to highlight significant differences between good- and poor-outcome cases concerning their latent correlation structures. The most evident difference was linked to the patients' use of abstract language, interpreted very positively by the therapists of poor-outcome cases and very negatively by the therapists of good-outcome cases. This observation was associated with the use of positive and negative emotional languages inversely proportional to abstract language in poor-outcome patients. Overall, this configuration was interpreted as a dynamic of "rationalization" occurring in poor-outcome patients only.
2. Regarding the "dynamic analyses", the results showed the possibility to describe the psychotherapy process, independently from the theoretical approach, with two quantitative dimensions (macro-parameters), namely, order-variability and elementary-complex. These two macro-parameters were statistically significant in describing the trajectory of each psychotherapy of the sample and, in so doing, supported the application of a statistical-mechanics approach to psychotherapy research.

Complementing these results, the present work investigates the analogies and differences of the linguistic networks of good- and poor-outcome cases using a network analysis approach.

MATERIALS AND METHODS

Sample

The sample was drawn from the York Depression Study I, a randomized clinical trial on the efficacy of brief experiential therapy [client-centered therapy (CCT) and emotion-focused therapy (EFT)] for depression (e.g., Watson et al., 1998). The York Depression Study I originally involved 17 CCT and 17 EFT treatments. For the present study, a subsample, the six best-outcome cases (CCT = 3; EFT = 3) and the six worst-outcome cases (CCT = 3; EFT = 3), was selected. The selection was based on the Reliable Change Index (i.e., RCI; Jacobson and Truax, 1991) of the Beck Depression Inventory (BDI; Beck et al., 1961, 1988). Then, four cases (1 = EFT; 3 = CCT) were excluded due to some missing sessions. The eventual sample, therefore, comprised eight cases: four with a good outcome (1 = CCT and 3 = EFT) and four with a poor outcome (2 = CCT and 2 = EFT) (**Table 1**). For more details on the sample, see Mendes et al. (2010).

Patients

The patients were one man and seven women with a mean age of 37.08 years (SD = 12.43); all met the criteria for major depressive disorder (MDD) as defined by the Structured Clinical Interview for DSM-III-R (SCID; Spitzer et al., 1989).

Therapists

The therapists were seven women and one man with an average of approximatively 5.5 years (SD = 1.7) of therapeutic experience and 24 weeks of training in experiential psychotherapy (Greenberg et al., 1993, 1994). Only one patient was assigned to each therapist, resulting in eight different therapeutic dyads. All therapists were monitored for adherence using video recordings of the therapy sessions and engaged in weekly supervisions during the period of the investigation.

Treatments

Client-centered therapy emphasizes the use of empathy, positive regards, and congruence (see, for instance, Rogers, 1951; Greenberg et al., 1994). EFT integrates CCT with "process-directive gestalt and experiential interventions" for the resolution of dysfunctional cognitive–affective processing (Watson et al., 1998, p. 210). The treatment length was between 15 and 20 sessions (M = 17.62, SD = 1.38), for a total of 141 sessions.

Measures

The semantic production of the eight brief psychotherapies was coded according to Mergenthaler's Therapeutic Cycle

TABLE 1 | Descriptive statistics of the sample.

Case number	Client acronym	Treatment	BDI pre–post improvement	Outcome
1	Primo	EFT	1	Poor
2	Secondolo	CCT	6	Poor
3	Terzio	CCT	4	Poor
4	George	EFT	2	Poor
5	Jan	EFT	25	Good
6	Margareth	CCT	12	Good
7	Lisa	EFT	22	Good
8	Sarah	EFT	31	Good

EFT, Emotion-focused therapy; CCT, client-centered therapy; BDI, Beck Depression Inventory.

Model (TCM; Mergenthaler, 1996, 2008, 2011). This is a computer-assisted deductive content analytic tool that breaks the transcript down into chunks of 150 word-blocks and subsequently analyzes these word-blocks according to three different categories (called "dictionaries"): (a) positive emotional tone (POS), (b) negative emotional tone (NEG), and (c) abstraction (AB). The first two contain adjectives, verbs, or adverbs with a positive or negative valence (e.g., happy, sad; agree, disagree; hug, abandon; incredible, astonished). The third contains abstract words (e.g., year, hour, accident, soul, and wedding). All sessions were transcribed according to the TCM international standards (Mergenthaler and Stinson, 1992). The TCM automatically assesses the relative frequency of the three dictionaries for each word-block.

In short, the dataset included six variables (statistical descriptors) as columns – abstract, positive, and negative language pertaining to patient and therapist of each therapeutic dyad – and the word-blocks in temporal order as rows (statistical units).

General Methodological Considerations

The limited sample size makes our investigation more similar to a "feasibility study" with a methodological aim than to a classical hypothesis testing approach. At this stage of development, we wish to give a proof of concept of the consistency, stability, and interpretability of the results grounded on the application of such a new methodological path. In so doing, we controlled for the presence of evident biases in the analyses. Concerning the experimental sample selection, this check was based on the inclusion of patients with similar age and psychotherapists with a comparable clinical experience. The reliability of the dynamical profiles (Markov Transition Matrices) stemmed from both the adequate length of the analyzed series (each statistical unit is a 150 word-block pertaining to an entire brief psychotherapy with an average of 17 sessions) and the elimination of scarcely populated clusters (states). It is worth noting that, in order to promote the passage from the search of a "proof-of-concept" to a fully operative investigation, it will be necessary to collect a much higher number of subjects.

Data Analysis

In order to transform, visualize, and investigate the psychotherapeutic process as a network, we used a symbolic dynamics approach: we considered each psychotherapy as a discrete time series consisting of different states that are progressively visited by the system (i.e., psychotherapeutic relationship). The states are generated by a data-driven clustering technique based on the co-occurrence of patterns of elementary symbols. Cluster analysis is routinely used to code time series as sequences of discrete states in which each state corresponds to a cluster (Kitchens, 2012). This transformation allows one to develop a reliable symbolic dynamic (Karpen et al., 1993), in this case, a time series of clusters representing the evolution of the patient's linguistic behavior over time (**Appendix 1**).

Each configuration of the linguistic variables (i.e., POS, NEG, and AB) in a given time point can be seen as a specific state of the system or node of its network and represents the position of the system in a multidimensional space. The configurations that recur over time pertain to the same cluster that, in turn, can be considered as "quasi-attractors" (i.e., a more stable state) of the psychotherapeutic system (Karpen et al., 1993; Graben and Hutt, 2015) (**Appendix 1**). The transitions of the system across such states is represented by a network having clusters as nodes (i.e., states of the system) and the frequency of the transition between one state (i) and another (j) as edges. In order to spot potential differences between good- and poor-outcome dynamics, the transition probabilities between different clusters are studied through Markov matrices. The rows of Markov Transition Matrix (MTM) represent the conditional probability of going from state i (row) to state j (column) in a single step. The matrix corresponds to a phase space diagram having as rows the Xt values and as columns the $Xt + 1$ values (i.e., the states of the system at time t and $t + 1$). The values within each cell, $Tmij$, represent the probability of going from state i to j in a single step; thus, they correspond to the observed conditional probabilities at subsequent points in time: $P[I(t)]\,|\,J(t-1)$ (Feller, 1968). MTMs offer a way to generate the characteristic network of good- and poor-outcome cases while at the same time presenting each therapist's and patient's individual network.

Hence, the distribution of cluster transitions was subsequently analyzed for both good- and poor-outcome cases as well as for both the therapists and patients. The comparison between different dynamics was accomplished by using both a direct statistic (Pearson correlation between pairs of MTMs) and a model-mediated measure (multivariate regression model testing the relative weights of the distance between state i and j, and their relative frequencies to predict the transition probabilities). The Pearson correlations between networks of poor- and good-outcome cases can be seen as a measure of the stability and accuracy of the clusterization. The higher the Pearson correlations, the more the clusterization was able to catch the main information in the eight psychotherapeutic processes.

On the other hand, the model-mediated measures (multivariate models, **Table 5**) are based on the significance of two regressors (see the next section for details). The model gives rise to two numerical indices representing the normalized coefficients of the two regressors for both patients and therapists (β values, **Table 5**). The sensitivity of such bi-dimensional description in grasping the main information of both the patients and therapists' networks can be observed in the proportion of variance explained by the model (adjusted R^2, 0.75 for patients, 0.68 for therapists, **Table 5**): such level of accuracy is fully satisfactory.

Since it is easier to understand and visualize a procedure through direct application, a more detailed description of the method is provided in the section hereafter.

RESULTS

In order to study the dynamic interaction between patients and therapists and the potential difference in poor- and good-outcome cases, we applied symbolic dynamics, a mathematical procedure widely used to discretize continuous variables, revealing their temporal occurrences. Therefore, we studied the best cluster solution for the linguistic data matrix of patients and therapists separately (i.e., three dictionaries, abstract language "AB", positive emotional "POS" and negative emotional "NEG" language for patients and therapists). We took the two most broadly used clusterization algorithms, namely, K-means and Minimum Spanning Tree, into consideration. The best cluster solution, balancing quantity of information and clarity of interpretation, turned out to be K-means with eight clusters for both patients and therapists, explaining the 65% and 68% of the variance, respectively. The rationale of applying the clusterization to patients and therapists separately is that this allows one to study their dynamic interactions over time, information that would have otherwise been missed. Hence, the K-means algorithm was applied separately over the three linguistic variables of patients and therapists. This resulted in a numeric label (from one to eight) for each statistical unit (or row of the dataset), indicating the cluster the specific observation pertains to. Each number corresponds to a specific state of the system or profile of the three dictionaries, and when that specific state recurs over time, so does the number generated by the algorithm. Clinically, this could be seen as a study of invariants of the patients' narratives (e.g., the patient's object relations are repetitive patterns trough which he/she perceives the reality and himself/herself).

The clusters that were very scarcely populated, that is, with very few occurrences (two for the patients and three for the therapists) were considered "outliers" and consequently their statistical units were deleted from the investigation. It is worth noting that these outliers, considering the multidimensional scaling, also lay at a very far distance compared to the other clusters. This confirms the substantial consistency of the resulting phase space of the therapeutic processes (i.e., distant regions of the space are only very rarely explored by the system). Accordingly, the accepted cluster solutions were six and five clusters (or states of their systems) for patients and therapists, respectively. See **Appendix 2** for the multidimensional scaling planes, clusters' frequencies, and centroids of the patients and therapists' phase space.

The time series of clusters generated by the K-means algorithm (i.e., eight for the patients and eight for the therapists) gave rise to first-order Markov transition matrices. Rows and columns contained the different clusters; the elements of each cell represented the normalized frequency of a direct (single step) transition from row (i) to column (j). Hence, in each cell of the matrix, there was a relative probability of passing from the state or cluster in row to that in column. We show, as an example, the transition matrix of the poor-outcome patient George (**Table 2** and **Figure 1**).

The Markov matrices of eight patients and eight therapists seem to be highly correlated (average Pearson $r = 0.78$; st. dev. = 0.46 and $r = 0.82$; st. dev. = 0.10 for therapists and patients, respectively), pointing out a considerable invariance of the therapeutic dynamics. This represents a prominent proof of concept of the possibility to consider psychotherapy as a proper dynamical system advocating its investigation by using classical physically inspired methods (i.e., regardless of the peculiarities of each psychotherapeutic process, there is a large amount of shared information among these eight cases; this allows us to investigate the principles ruling this common dynamic). It is worth noting that the standard deviation of the Pearson correlation was four times higher for therapists than for patients, suggesting that while therapists attempt to "dynamize" the clinical field, the patients' linguistic behavior is more redundant.

Subsequently, in order to shed more light on the different behaviors characterizing the dynamics of patients and therapists, we used a new combined index, here named as "DeltaCorr" (Equation 1).

Equation 1. "DeltaCorr."

$$\mathrm{DeltaCorr}(i, j) = \mathrm{CorrPat}(i, j) - \mathrm{CorrTher}(i, j)$$

[*Example*:

$$DeltaCorr(Sarah, Lisa) = CorrPat(Sarah, Lisa) - CorrTher(Sarah's\ Therapist, Lisa's Therapist)]$$

TABLE 2 | The number of clusters or states of the system is indicated in the rows and columns.

	George (poor outcome): Markov transition matrix							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	0.237	0.042	0.203	0.025			0.195	**0.297**
2	0.025	0.125	**0.325**	0.125			**0.325**	0.075
3	0.159	0.057	0.248	0.038			0.217	**0.280**
4	0.121	0.030	0.212	0.091			0.121	**0.424**
5								
6								
7	0.139	0.062	0.206	0.026			**0.289**	**0.278**
8	0.129	0.031	0.133	0.043			0.246	**0.418**

Each cluster is composed of a peculiar configuration of the three linguistic vocabularies. Empty cells correspond to clusters that have been deleted because they are considered as "outliers" (scarcely populated and located at the extremes of the distribution). In each cell, the relative probability of passing from the state or cluster in row to that in column is indicated. The most probable transition for each state is highlighted in bold.

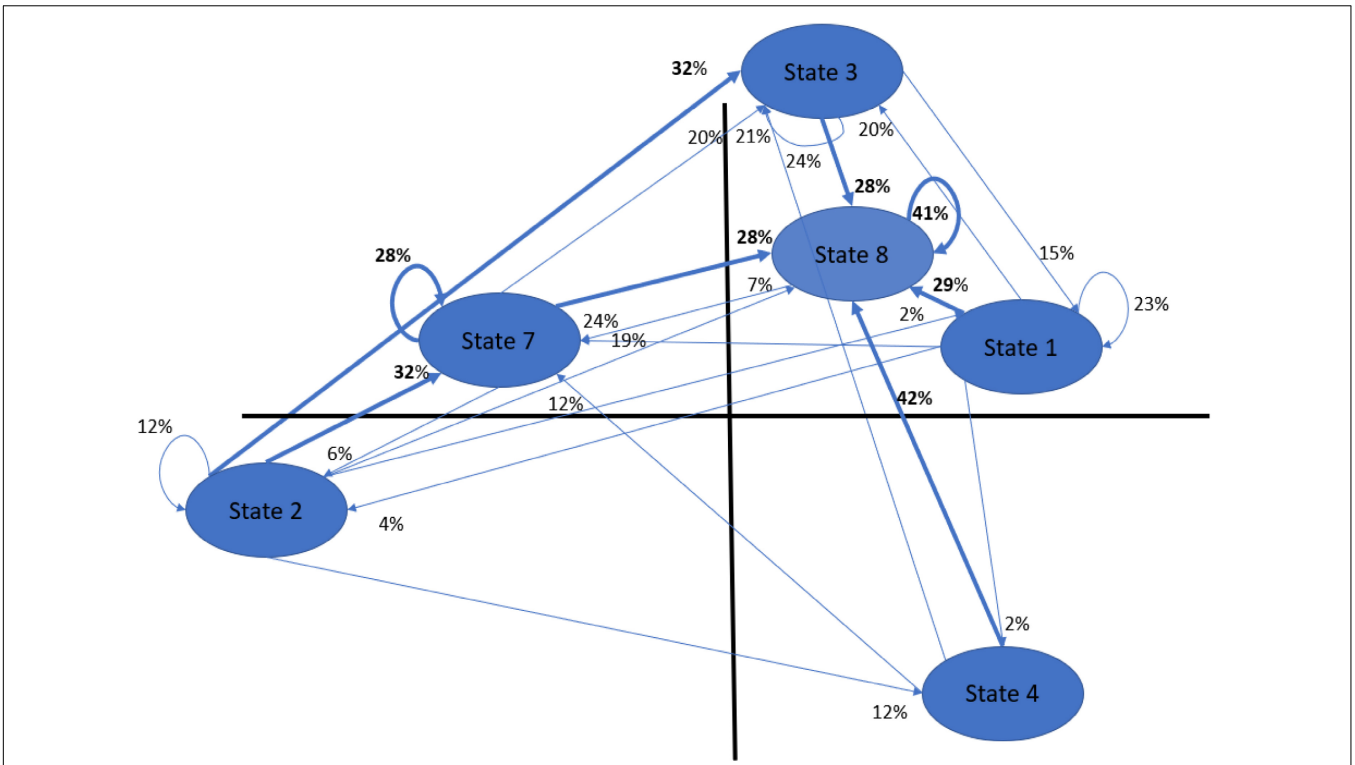

FIGURE 1 | Graphic visualization of George's MTM or George's linguistic network. Transitions with the highest occurrence for each state are in bold. In this case, we see a clear tendency to pass through state 8 (i.e., silence, the only state in which all three dictionaries show a minus sign), which is the most frequent state with 2191 occurrences (on a total of 7388). Second ranked was cluster 3 with 1494 occurrences, followed by cluster 7 (1484), and finally, cluster 1, cluster 4, and cluster 2, with 1115, 709, and 371, occurrences, respectively (see **Appendix 2, Table III**). To interpret the profile of each state, see **Appendix 2, Table II**.

Where CorrPat(i, j) = Pearson correlation between the i and j Markov matrix pertaining to patients. CorrTher(i, j) = Pearson correlation between the i and j Markov matrix pertaining to therapists.

Table 3 shows the means and standard deviations of DeltaCorr across poor- and good-outcome cases.

The discrepancy (DeltaCorr) between the therapists and patients' dynamics was two times higher within poor–poor correlations than in good–good correlations, and of opposite sign (0.105 vs. −0.048, respectively). Additionally, the values of DeltaCorr within the poor–poor class (i.e., outcome) were the only ones in which the 95% confidence interval (CI = 0.025 to 0.185) did not include the zero value. Hence, we can affirm the presence of a difference, although small, between the patients and therapists' linguistic dynamics. The greater variability within the correlations of poor-outcome therapists' Markov transition matrices can be interpreted as a bigger effort exerted by the therapists to deal with poor-outcome patients. Of course, it is impossible to conclude whether this greater variability in the behavior of poor-outcome therapists depended on a deliberately different therapeutic approach or was rather related to the difficulty of the clinical process in which they were involved. In the latter case, it could be a sign of two opposite clinical pictures: a particularly difficult patient pushing the therapist to find new and previously unexpected solutions to manage the impasse, or a therapist who is so lost in the clinical process that tries random interpretations. Whatever the case may be, the result is an empirical increase in the standard deviation of the therapists' linguistic behaviors and a poor therapeutic outcome measured at the end of the treatment.

TABLE 3 | Means and standard deviations of DeltaCorr across different outcome classes.

Variable	N	Mean	St. Dev.	Minimum	Maximum
Class = poor–poor					
CorrTher	6	0.725	0.101	0.560	0.840
CorrPat	6	0.830	0.037	0.780	0.870
DeltaCorr	**6**	**0.105**	**0.100**	**−0.020**	**0.270**
Class = good–good					
CorrTher	6	0.845	0.059	0.760	0.940
CorrPat	6	0.796	0.031	0.760	0.850
DeltaCorr	6	−0.048	0.077	−0.130	0.090

The highest value of DeltaCorr is indicated in bold.

So far, we gained two main insights from the application of network analyses on our dataset: we observed a very high consistency of therapists and patients' dynamics (average Pearson r = 0.78; st.dev. = 0.46 and r = 0.82; st.dev. = 0.10 for therapists and patients, respectively), and a small but significant difference in the linguistic behavior of therapists (DeltaCorr 0.105 vs. −0.048 for poor- and good-outcome cases, respectively).

In what follows, we will move from the study of patients and therapists separately to the study of psychotherapeutic *dyads*. In order to study the psychotherapeutic dyads and their clinical processes, we made use of combined symbolic dynamics produced by the interpolation of patients and therapists' single trajectories. For instance, GeorgePat1, GeorgeTher1, GeorgePat2, GeorgeTher2.GeorgePat(*n*), GeorgeTher(*n*), where Pat(*i*) and Ther(*i*) are the states or clusters progressively visited by patient and therapist during their interaction. This procedure makes the corresponding first-order Markov transition matrix a Patient-to-Therapist sequence of discrete transitions. As an example, the poor-outcome Patient-to-Therapist interaction of George is shown below (**Table 4**).

Analogously to what has been observed in the case of patients and therapists' individual trajectories, the Patient-to-Therapist symbolic dynamics also demonstrated a very high consistency (average Pearson correlation: $r = 0.872$; st. dev. = 0.038) that proves the similarity of their interacting behaviors and dynamical principles. This observation was further confirmed by the high consistency in Therapist-to-Patient symbolic dynamics [example: GeorgeTher1, GeorgePat1, GeorgeTher2, GeorgePat2.GeorgeTher(*n*), GeorgePat(*n*); average Pearson correlation: $r = 0.848$; st. dev. = 0.044] and between Patient-to-Therapist and Therapist-to-Patient dynamics (average Pearson correlation: $r = 0.892$; st. dev. = 0.032).

After demonstrating the strong similarities between the patients' linguistic behaviors, the therapists' linguistic behaviors and the patient-therapist dyads, we now bring the attention to the study of the principles that determine these linguistic dynamics.

Do the symbolic dynamics of patients and therapists follow a specific principle? To answer this question, we rely on two opposite modes of functioning:

A) Distance-Dependent

The transition dynamic depends on the Euclidean distance between clusters (i.e., most of the transitions occur between neighboring clusters, only a minority take place between distant ones). In this case, the transitions depend on the distance between the cluster from which the transition starts (*i*) and the cluster in which the transition ends (*j*). This means that the transitions between the *i* and *j* states are negatively correlated with their mutual distance. The area of the phase space (i.e., the network) in which most of the transitions take place can be regarded as the system's attractor (i.e., the most recurrent state or group of states). In the clinical practice, it could be represented by an impasse (if the attractor is dysfunctional) or a positive transference (if the attractor is functional).

TABLE 4 | George's patient-to-therapist symbolic dynamic.

	George patient-to-therapist dynamic							
Cluster/state	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	0.066	0.246	0.016	0.131			0.361	0.18
2	0.103	0.069	0.138	0.052			0.284	0.353
3	0.014	0.264	0	0.125			0.389	0.208
4	0.133	0.084	0.12	0.12			0.229	0.313
5								
6								
7	0.084	0.113	0.122	0.084			0.303	0.294
8	0.061	0.187	0.075	0.14			0.299	0.238

Empty cells correspond to clusters that have been deleted because they were considered as "outliers." In each cell, the relative probability of passing from the state or cluster in row to that in column is indicated.

B) Dependent on the Relative Frequency of the j State

In this case, the transitions depend on the number of occurrences of the state in which the transitions end. This means that the transitions between the *i* and *j* states are positively correlated with the relative frequency of *j*. Each state can be reached by any other state regardless of distance; the system is called "ergodic." In the clinical practice, this could be represented by a flexible and healthy patient capable of expressing himself regardless of his anxiety (functional picture), or a patient with severe thought disorders incapable of focusing his attention on a single internal state because of extreme anxiety (dysfunctional picture).

It can be useful to consider a third mode (c) that is situated in the middle of the two aforementioned modes of functioning. This consists of a system's trajectory that depends on the relative frequencies of both the *i* and *j* states. In this case, the transitions are positively correlated with the number of occurrences of both *i* (the state from which the transition starts) and *j* (the state in which the transition ends). This means that the system is not completely ergodic because its transitions depend, even if only partially, also from the state in which the transition starts. In other words, the system's initial position influences the next step. This has been called the "Drunkard's walk" [i.e., random walk, first defined by Pearson (1905)] in which, on the one hand, you will never know where the drunk man will step next, yet, on the other, the possibilities are limited by how far the drunk man can widen his legs. Clinically, it is a very common relational picture: usually, a therapist waits long enough in order for the patient to be ready to accept a given comment or interpretation, that is, until the therapist believes that the patient's mind is sufficiently "widened." Alternatively, in the case of an out-of-time interpretation, it is common to experience a rejection by the patient, suggesting that the interpretation was too far away from his current mind's amplitude.

Mathematically, testing the above-outlined models would correspond to exploring the fit of a multiple regression model with the Markov transitions (i.e., the value of each cell of the Markov matrix) as dependent variable (Y) and, as regressors (Xs, independent variables): the distance between state *i* and *j* ($X1$, mode "a"); the relative frequency of state *j* ($X2$, mode "b"); the product of the relative frequencies of both state *i* and *j* ($X2$, mode "c"). At the end of the procedure, each trajectory is expressed as an equation like $Y = aX1 + bX2$, where *a* and *b* are normalized coefficients and represent the relative importance of the independent variables.

The multiple regression model that most significantly described the symbolic dynamics of patients and therapists is the following (Equation 2):

Equation 2. Best fitted Multiple Regression Mode.

$$Y \text{ (Markov matrix linearized)} =$$

$$aX1 \text{ (distance between state } i \text{ and } j) + bX2 \text{ (composite frequency}$$

$$= \text{ relative frequency of state } i * \text{ relative frequency of state } j)$$

where a and b are the weights of the independent variables.

The model fitted very well for both patients and therapists' dynamics. The mode (c), as discussed above, lies between the two proposed modes of functioning (a and b), because it makes the transitions depend not only on the state in which the transition ends but also on the state from which the transition starts. We show the results of the multiple regression model applied to each subject below (**Table 5**):

The results for poor-outcome patient George will be discussed as an example, they are presented in the table from left to right. "β distance" is the coefficient "a" of equation 2 and represents the importance of the distance between state i (begin) and j (end) in explaining the variance of George's Markov transitions. "β composite frequency" is the coefficient "b" of Equation 2 and represents the importance of the relative frequencies of state i and j in explaining the variance of George's Markov transitions. "R" is the square root of R^2 and is the correlation between the observed and predicted values of the dependent variable. "R^2" is the proportion of variance in the dependent variable (Y) that can be explained by the independent variables ($X1$, $X2$); it does not reflect the extent to which any particular independent variable is associated with the dependent variable. "Adjusted R^2" is an adjustment of the R^2 that penalizes the addition of extraneous predictors to the model. Adjusted R^2 is computed using the formula $1-(1-R^2)((N-1)/(N-k-1))$, where k is the number of predictors. The "p value" represents the statistical significance of the model. "β composite/β distance" is the value resulting from dividing the two β coefficients. It represents the proportional importance of the model's independent variables. In the case of George, the composite frequency is 2.4 times more important than distance in describing the Markov transitions.

As we can read from **Table 5**, the model explains the data variance for both therapists and patients very well (average R^2 = 0.763; average adjusted R^2 = 0.729, corresponding to 76% and 73% of variance explained). The high predictive value of the model demonstrates that the transition dynamics depended on the distance and relative frequencies of both state i (state from which the transition starts) and j (state in which the transition ends). Therefore, as an answer to the question on the nature of transition dynamics (i.e., do the symbolic dynamics of patients and therapists follow a specific principle?), we can state that there were no significant differences between good- and poor-outcome patients. The transition dynamics of both therapists and patients followed a specific trend, and for the most part, it depended on the composite frequency (the product between relative frequency of state i and j). Precisely, the composite frequency weighs 2.4 and 17 times more than the distance for patients and therapists, respectively. This difference is mainly explained by their β distance coefficients: the therapists' transitions depended approximately 10 times less on distance than those of patients (ratio between absolute values of their β coefficients = 0.343/0.035 = 9.8). This result is in complete

TABLE 5 | Results of the multiple regression model applied to each subject.

			Multiple regression model				
Patients	**β distance (normalized)**	**β composite frequency (normalized)**	***R***	***R*²**	**Adjusted *R*²**	***p***	**β composite/β distance**
George	−0.295	0.709	0.864	0.746	0.717	<0.0001	2.403
Primo	−0.373	0.697	0.896	0.803	0.781	<0.0001	1.869
Secondolo	−0.405	0.663	0.896	0.803	0.781	<0.0001	1.637
Terzio	−0.149	0.806	0.872	0.761	0.734	<0.0001	5.409
Jan	−0.369	0.673	0.873	0.762	0.735	<0.0001	1.823
Lisa	−0.476	0.645	0.928	0.861	0.845	<0.0001	1.355
Margareth	−0.452	0.676	0.941	0.885	0.872	<0.0001	1.495
Sarah	−0.220	0.763	0.869	0.754	0.727	<0.0001	3.468
Mean	*−0.343*	*0.704*	*0.892*	*0.797*	*0.774*	*<0.0001*	*2.432*
Therapists	**β distance (normalized)**	**β composite frequency (normalized)**	***R***	***R*²**	**Adjusted *R*²**	***p***	**β composite/β distance**
George	0.271	1.006	0.888	0.789	0.754	<0.0001	3.712
Primo	−0.036	0.827	0.845	0.714	0.667	<0.001	22.972
Secondolo	0.057	0.915	0.89	0.793	0.758	<0.0001	16.052
Terzio	−0.025	0.784	0.798	0.638	0.577	<0.002	31.36
Jan	−0.069	0.892	0.927	0.859	0.835	<0.0001	12.927
Lisa	−0.056	0.750	0.782	0.612	0.547	<0.003	13.393
Margareth	0.109	0.875	0.831	0.690	0.639	<0.001	8.027
Sarah	0.031	0.877	0.862	0.743	0.700	<0.0001	28.29
Mean	*0.035*	*0.866*	*0.853*	*0.730*	*0.684*	*<0.001*	*17.092*

TABLE 6 | Results of odds ratios between the first and third part of each psychotherapy.

Odds ratios					
Subject	**Outcome**	**State/ cluster**	**First part**	**Third part**	***p* value**
Secondolo (Therapist)	Poor	1	13/322	2/322	$p = 0.014$
Terzio (Therapist)	Poor	2	53/245	78/244	$p = 0.050$
Terzio (Therapist)	Poor	7	91/245	53/244	$p = 0.005$
Lisa (Patient)	Good	8	100/257	61/255	$p = 0.008$
Margareth (Patient)	Good	1	47/413	69/413	$p = 0.056$
Margareth (Therapist)	Good	1	12/407	4/406	$p = 0.059$
Margareth (Therapist)	Good	4	68/407	44/406	$p = 0.035$

For the sake of simplicity, we only show the results with a significant p value.

accordance with the greater variability of the correlations of poor-outcome therapists' Markov transition matrices, which we interpreted as a bigger effort performed by the therapists in dealing with the poor-outcome patients (**Table 3**). These findings suggest that the behavior of poor-outcome therapists was more dynamic and unconstrained or, in other words, showed less dependence on the distances between states.

After having clarified the nature of the transition dynamics for both patients and therapists, we now present the analyses of the possible difference in the number of occurrences (i.e., frequencies) of the states at the beginning and end of therapy. In order to do so, we used odds ratio (chi-square statistics). An odds ratio (OR) is usually a measure of association between an exposure and an outcome. The OR represents the odds that an outcome (in our case a difference in the number of occurrences of a given state) will occur given a particular exposure (the distribution of states of that specific symbolic dynamic), compared to the odds of the outcome occurring in the absence of that exposure. In the present study, we checked for the presence of significant differences in the occurrences of states between the first part (the first 33% of observations) and the third part (the last 33%) of each psychotherapy. The results are shown below (**Table 6**).

We observed some significant changes in the linguistic behavior between the beginning and end of therapy for two poor-outcome therapists (the psychotherapists of Secondolo and Terzio), two good-outcome patients (Lisa and Margareth), and one good-outcome therapist (the psychotherapist of Margareth). The results corroborate the hypothesis that "poor-outcome" therapists try more often to "dynamize" their psychotherapeutic fields compared to their "good-outcome" colleagues, thereby resulting in an increased linguistic variability. Specifically, the therapist of Secondolo reduced the state with a high use of negative emotional language (cluster 1, **Appendix 2, Table II**). The therapist of Terzio increased the state with high abstract language (cluster 2, **Appendix 2, Table II**) and decreased the state with all the three dictionaries showing a minus sign (silence, cluster 7, **Appendix 2, Table II**).

On the patients' side, on the contrary, it seems that the good-outcome cases are those patients showing significant changes. In particular, Lisa decreased the state with all the three dictionaries showing a minus sign (silence, cluster 8, **Appendix 2, Table II**). Margareth, on the other hand, increased the state with a positive sign for positive and abstract language (cluster 1, **Appendix 2, Table II**), while her therapist (the only good-outcome therapist showing significant changes) decreased the use of the state that was characterized by more negative emotional language (clusters 1 and 4, **Appendix 2, Table II**).

CONCLUSION

Answering the central aim of our study, we found that the application of a statistical-mechanics-inspired approach to psychotherapy research indeed allowed us to abstract the main macro-parameters of the eight psychotherapies of our sample and to investigate the analogies and differences in the linguistic networks of good- and poor-outcome cases. We gained two main insights from the network analyses applied on our dataset:

a) A significantly greater variability in the linguistic behavior of poor-outcome therapists in comparison to good-outcome therapists;
b) A very high consistency in the dynamics of both therapists and patients (average Pearson $r = 0.78$; st. dev. = 0.46 and $r = 0.82$; st. dev. = 0.10 for therapists and patients, respectively), as well as in the way they interacted (Patient-to-Therapist symbolic dynamics, average Pearson correlation: $r = 0.872$; st. dev. = 0.038; Therapist-to-Patient symbolic dynamics, average Pearson correlation: $r = 0.848$; st. dev. = 0.044; between Patient-to-Therapist and Therapist-to-Patient symbolic dynamics, average Pearson correlation: $r = 0.892$; st. dev. = 0.032) was found.

The first observation (a) can be traced back to different findings:

- The results of "static analyses", as presented in the previous paper resulting from this study (de Felice et al., 2019b): when patients made use of abstract language, they were interpreted very positively by poor-outcome therapists but very negatively by good-outcome therapists. The good-outcome therapists probably (and correctly) considered this behavior as a patient's defense mechanism that needs to be addressed, while poor-outcome therapists considered this as a sign of working through.
- The discrepancy (DeltaCorr, **Table 3**) in the therapists and patients' dynamics proved to be two times higher within poor–poor correlations than in good–good correlations, and of opposite sign (mean DeltaCorr, poor–poor = 0.105 vs. good–good = −0.048, **Table 3**).
- In the multiple regression models, the composite frequency weighed 2.4 and 17 times more than the Euclidean distance for patients and therapists, respectively. The difference was mainly explained by their β distance coefficients: the therapists' transitions depended approximately 10 times less on distance than those of patients (ratio between absolute values of their β coefficients = 0.343/0.035 = 9.8, **Table 5**).

Overall, the greater variability in the behavior of poor-outcome therapists reflected their bigger effort to deal with their poor-outcome patients. Nevertheless, it is difficult to say with certainty if this greater variability in their behaviors depended on a deliberately different therapeutic approach or rather due to the difficulty inherent to the clinical process. The differences observed in the correlation matrix between good-outcome and poor-outcome cases seem to support the latter hypothesis. In fact, only the poor-outcome patients made use of positive and negative emotional languages inversely proportional to abstraction ("static analyses", de Felice et al., 2019b).

The second result of our study (b) represents a prominent proof-of-concept of the possibility to consider psychotherapy as a proper dynamical system, advocating for the application of classical physics-inspired methods to the study of psychotherapy. Even when considering the singularities of each psychotherapeutic relationship, the results of this study demonstrated the existence of a nucleus of invariants amenable to the principles of dynamical systems. The principles ruling the process of patients and therapists' dynamics were studied by means of multiple regression models that were able to accurately predict their symbolic dynamics by considering the joint frequencies of state i and j and their distance (average p value, patients < 0.0001, therapists < 0.001; average adjusted R^2, patients = 0.774, therapists = 0.684). The results show that their respective systems were not completely ergodic because their transitions depended also on the states in which the transitions started. In other words, their systems' initial positions influenced the following steps.

As mentioned earlier, this functioning can be described as the "Drunkard's walk" or "random walk"; in Pearson's words: "the lesson of Lord Rayleigh's solution is that in open country the most probable place to find a drunken man who is at all capable of keeping on his feet is somewhere near his starting point!" (1905; p. 294). This statement, from a clinical perspective, could resemble a definition of the Freudian concept of "compulsion to repeat" (Freud, 1914), by which the patient is unconsciously forced to re-experience a traumatic event or a relational pathological attitude while attempting to master the anxiety it provokes. The random-walk-like behavior of the eight psychotherapeutic dyads investigated in this study reflects this mode of functioning on a relational level. The psychotherapeutic interactions moved between adjacent and most occurring linguistic (i.e., mental) states, avoiding transitions toward the very far and least occurring ones (i.e., unexplored mental states). While the good-outcome therapists presumably judged their patients' networks as functional, the poor-outcome therapists tended to force the psychotherapeutic field toward the functional states more eagerly. This would explain the greater variability in the linguistic behavior of poor-outcome therapists. The clinical nucleus on which their concerns are focused seems to be related to the rationalization dynamic that emerged by means of "static analyses" (de Felice et al., 2019b). Only the poor-outcome patients made a use of positive and negative emotional language inversely proportional to abstraction, which suggests that they probably used the clinical setting to speak about concrete issues while avoiding emotional involvement. An open question concerns the poor-outcome therapists' awareness of that rationalization dynamic or, conversely, their limited ability to address it.

Despite the remaining questions, the methodology introduced in the present paper has the potential to open new avenues and to raise and answer new questions in psychotherapy research. Just to mention some of them, further research could study the following: the time spent in a dysfunctional state in poor- and good-outcome dyads, the minimum number of oscillations to produce an entirely new state or attractor, the way a therapist's intervention impacts the patient's network, the differences between networks of diverse psychotherapeutic approaches, and the treatment outcomes in relation to specific transition dynamics. All these research questions can be investigated by means of symbolic dynamics, using psychophysiological variables, such as heartbeat or galvanic skin response, as well as linguistic and non-verbal variables (e.g., Giuliani et al., 1994; Gorban et al., 2010; Halfon et al., 2016; Orsucci et al., 2016; Rybnikov et al., 2017). Moreover, other than the Euclidean, in future research, a fruitful investigation could concern the use of different distances between clusters, such as Manhattan and Mahalanobis, to analyze specific psychotherapeutic networks and clinical dynamics. In summary, studying psychotherapy in terms of complex systems and visualizing the psychotherapeutic field (Baranger and Baranger, 1961) as a network allows us to investigate psychotherapeutic evolutions over time and process-outcome relations in a completely novel and data-driven manner. The methodology presented in this manuscript can foster further efforts in the line of research that aims to unite psychotherapy and complexity science (de Felice et al., 2019a). Although we are perfectly aware that the analysis of eight brief psychotherapies poses severe limitations to the generalizability of our results, we are profoundly convinced that the importance and innovation of methods can represent a generative substratum capable of overshadowing that criticality.

Finally, we return to the two generic research questions that guided the research project (presented in the current and previous paper, see de Felice et al., 2019b): (a) the possibility of predicting good- and poor-outcome psychotherapies on the sole basis of the correlation pattern among their macro-parameters, and (b) the investigation, in terms of those correlation patterns, of analogies and differences between the processes of good- and poor-outcome cases.

a) Regarding the first question, our analyses confirmed the possibility to predict good- and poor-outcome psychotherapies on the sole basis of the correlation patterns among their macro-parameters. The results of the "dynamic analyses" presented in the previous paper (de Felice et al., 2019b) demonstrated the statistical significance of five macro-parameters, grouped into two main dimensions of order-variability and elementary-complex, in describing the singularities of each of the eight psychotherapeutic processes. Hence, we conclude that the rationale of Statistical Mechanics, which uses probability theory to study and predict the average behavior of systems in which microscopic details are obscure and/or

not measurable, proved to be not only suitable but also fundamental in producing a significant advancement in the psychotherapy research literature (de Felice et al., 2019b).

b) The second question was addressed in the present study. Analogies between the processes of good- and poor-outcome cases were demonstrated by the high consistency of the patients' dynamics, the therapists' dynamics and their interactions (Patient-to-Therapist and Therapist-to-Patient dynamics). Furthermore, by studying the principles ruling these dynamics, it was possible to observe their random-walk-like behavior. As such, the mind seems to be tied to its initial position or the "ordinary mental state." Subsequently, it is able to move toward diverse mental states, which, under the influence of some kind of homeostasis principle, appear to be the more adjacent and most occurring ones. Sigmund Freud called the tendency to repeat familiar, even if traumatic mental states, while avoiding the unexplored ones, "compulsion to repeat" (Freud, 1914). Even the most recent psychoanalytic theories, albeit with some differences, agree on the idea that patients use rigid relational patterns resulting from past relational experiences (e.g., Mitchell, 1993, 2014; Bromberg, 1998; Stern, 2013; Hoffman, 2014). Psychopathology, as well as psychic suffering, is therefore currently understood as the tendency to rigidly reiterate relational dysfunctional patterns and, consequently, therapeutic change is conceived as the gradual shift from rigid and repetitive relational patterns to more flexible ones (Bromberg, 2001; Stern, 2001).

On the other hand, the differences in the processes of good- and poor-outcome cases, as observed in this study, resulted from the greater variability in the behavior of poor-outcome therapists and the inversely proportional use of positive/negative emotional language and abstraction in poor-outcome patients. This result has been interpreted as a dynamic of rationalization characterizing the poor-outcome dyads.

In contrast to mainstream psychotherapy research characterized by the endless search for increasingly detailed mediation, moderation, hierarchical, multilevel models to explain the outcome of psychotherapy, the present study establishes the strength of a scientific effort that follows a completely different route: abstracting significant *trans*-theoretical, data-driven macro-parameters and studying their interactions over time. After confirming the possibility of collapsing eight psychotherapeutic processes into two main dimensions (order-variability and elementary-complex, see part one: de Felice et al., 2019b), the present study not only showed how to describe the clinical interactions in terms of networks but also found out the main principles on which their evolutions were based. The mind, from a linguistic perspective, seems to work-through psychotherapy sessions by passing from the most adjacent states and the most occurring ones. This finding can represent a fertile ground to rethink pivotal clinical concepts such as the timing of an interpretation or a comment, the clinical issue to address within a given session and the general task of a psychotherapist: from someone who delivers a given technique toward a consultant promoting the flexibility of the clinical field and, thus, of the patient's mind. Hence, we can recommend that the clinician should promote the patient's passage toward less explored mental states by softening the degree of anxiety they convey. In so doing, the patient's personality is enriched and he/she acquires the capacity of "feeling, thinking and being" (Matte-Blanco, 1988) previously unfamiliar internal aspects (anxiety-triggering). By this process, the patient will gain not only internal freedom but also the capacity of doing new experiences, different from the old relational pattern. Therefore, in terms of psychotherapeutic training, we should foster the competence of clinicians to *observe* the network of the patient's mind as-a-whole; to *listen to* the patient's need of keeping his/her mind within a certain dysfunctional organization (attractor) together with his/her desire to change (i.e., understanding what are the mental states impossible to integrate because of the anxiety they convey); to *interpret*, that is, promoting the emergence, in the patient's mind, of a more functional state or group of states (attractor) in which he/she can reside regardless of the anxiety they can, especially at the beginning, provoke. Note that the word "interpretation", although much more used in the psychodynamic schools, can be seen as having both behavioral and verbal components. Even an orthodox psychoanalyst is constantly delivering a behavioral treatment: despite the possible hate or any kind of attack the patient can address him/her, he/she continues to be there, listening to his/her patient. Hence, in this context, the word interpretation should be considered as a *trans*-theoretical capacity of the clinician to let emerge, in the clinical relationship, new behavioral and relational patterns, previously unexplored because of the anxiety they triggered. Observation, listening, and interpretation, from this perspective, can be considered as the three main elements of the clinical relationship and training (de Felice, 2020).

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

AUTHOR CONTRIBUTIONS

GF and AG: conceptualization. GF, AG, AS, and FO: methodology. GF, AG, AS, OG, and EM: formal analysis. GP, MD, and SA: data curation. GF, FO, GS, and RM: writing – original draft preparation. GF, AG, MD, OG, SA, GP, GS and RM: writing, review, and editing.

ACKNOWLEDGMENTS

We are grateful to Les Greenberg for providing the transcripts of these cases.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.00788/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 11 August 2020
doi: 10.3389/fpsyg.2020.01922

A Mixed Methods Framework for Psychoanalytic Group Therapy: From Qualitative Records to a Quantitative Approach Using T-Pattern, Lag Sequential, and Polar Coordinate Analyses

Eulàlia Arias-Pujol[1] and M. Teresa Anguera[2]*

[1] FPCEE Blanquerna, Ramon Llull University, Barcelona, Spain, [2] Faculty of Psychology, Institute of Neurosciences, University of Barcelona, Barcelona, Spain

OPEN ACCESS

Edited by:
Reitske Meganck,
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Reviewed by:
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Rafael E. Reigal,
University of Malaga, Spain

****Correspondence:***
Eulàlia Arias-Pujol
eulaliaap@blanquerna.url.edu

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *03 November 2019*
Accepted: *13 July 2020*
Published: *11 August 2020*

Citation:
Arias-Pujol E and Anguera MT (2020) A Mixed Methods Framework for Psychoanalytic Group Therapy: From Qualitative Records to a Quantitative Approach Using T-Pattern, Lag Sequential, and Polar Coordinate Analyses. Front. Psychol. 11:1922. doi: 10.3389/fpsyg.2020.01922

Conducted within a mixed methods framework, this study focuses on the conversation-facilitation role of a lead therapist during group psychotherapy with adolescents. Conversation is an essential component of psychoanalytic psychotherapies and there is growing interest in describing and studying the impact of conversational techniques. One way to do this is to report on specific approaches, such as questioning, paraphrasing, and mentalization in intervention turns and to analyze their impact on the therapist-patient relationship. The main aim of this study was to investigate differences in communication strategies used by a lead therapist in the early and late stages of therapy with six adolescents aged 13–15 years. We employed a mixed methods design based on systematic direct observation supplemented by indirect observation. The observational methodology design was nomothetic, follow-up, and multidimensional. The choice of methodology is justified by our use of an *ad hoc* observation instrument for communication strategies combining a field format and a category system. We analyzed interobserver agreement quantitatively by Cohen's kappa using GSEQ5 software. Following confirmation of the reliability of the data, we analyzed the lead therapist's conversation-facilitation techniques in sessions 5 and 29 of a 30-session program by quantitatively analyzing what were initially qualitative data using T-pattern detection (THEME v.6 Edu software), lag sequential analysis (GSEQ5 software), and polar coordinate analysis (HOISAN v. 1.6.3.3.6. software and R software). The results show changes in the techniques used from the start to the end of therapy. Of the 28 communication strategies analyzed, three were particularly common: questioning and paraphrasing in session 5 and questioning and mentalization in session 29. This mixed methods study shows that combined use of T-pattern detection, lag sequential analysis, and polar coordinate analysis can offer meaningful and objective insights into group psychotherapy through the lens of the therapist.

Keywords: mixed methods, QUAL-QUAN-QUAL integration, group therapy, adolescents, psychotherapist interactions

INTRODUCTION

The use of mixed methods in psychotherapy research has grown in recent years (Bartholomew and Lockard, 2018; Del Giacco et al., 2019, 2020; Halfon et al., 2019; Roberts and Allen, 2019; Venturella et al., 2019). Researchers working as psychotherapists have underlined the need to integrate the objectivity of quantitative methods with the creativity of qualitative and mixed methods in order "to put the flesh of clinical meaning on the bones of quantitative outcomes" (Target, 2018, p. 18). Psychotherapy research covers a field of great complexity. Some of this flexibility can be captured and understood through the analysis of qualitative and quantitative data within a mixed methods design to shed light on what lies beneath multimodal interactions that precede change in psychotherapy. A mixed methods design offers an objective and scientifically rigorous yet flexible approach for capturing change and continuity over the course of psychotherapy. An observational methodology is perfectly suited to the study of spontaneous behavior in natural settings (Anguera et al., 2018), and as such, is ideal for analyzing the regular interactions that occur between therapists and patients in a range of psychotherapy settings (individual, group, or family therapy) and, more specifically, in psychoanalytic therapy settings (Arias-Pujol and Anguera, in press). The process for analyzing change in psychotherapy is well established and plenty of opportunities exist within this process (from the definition of the research question to the interpretation of systematically collected and recorded data) to integrate both qualitative and quantitative elements.

Conventionally speaking, mixed methods studies integrate qualitative and quantitative perspectives (Johnson et al., 2007; Creswell and Plano Clark, 2017; Onwuegbuzie et al., 2018) in drawing on all types of data, including observational datasets, narratives, in-depth interviews, survey results, and measures from physiological and other tests, including repeated measures taken over the course of a single study. The means by which these data can be linked has grown exponentially, giving rise to numerous conceptual nuances, a long list of study designs, and a future that promises to end decades of methodological confrontation.

The very essence of the observational methodology consists of seeking complementarity through the integration of qualitative and quantitative elements. A key strength of the observational methodology is that it rigorously guarantees quality through the objective analysis of rigorously collected and processed qualitative data that can be analyzed robustly and quantitatively without loss of information richness (Anguera et al., in press).

Observational methodology is thus itself a mixed methods approach (Anguera et al., 2017a). Although relatively novel, it has shown enormous promise and is growing in popularity in a range of scientific fields, including psychology. In their review of mixed methods in psychotherapy research, Bartholomew and Lockard (2018) reported that a considerable proportion (32.26%) of these studies have focused on group interventions. While most studies have been conducted in adults, some have been conducted in adolescents (Down et al., 2011) and children with emotional and behavioral problems in groups (Swank and Shin, 2015) and individual psychodynamic play therapy (Halfon et al., 2016). Our group has used observational methodology to analyze group psychotherapy in previous studies (Vaimberg, 2010; Roustan et al., 2013; Arias-Pujol and Anguera, 2017; Alcover et al., 2019) and in the empirical part of this article. In the latter we demonstrate the different steps involved in the QUAL-QUAN-QUAL transformation of data and show how the "connecting" method (Creswell and Plano Clark, 2017) is an ideal way to link qualitative and quantitative elements within a systematic observation framework.

There is growing interest in describing and studying the impact of psychoanalytic therapy techniques (Midgley et al., 2018) from different perspectives, with researchers continuing to search for answers to the question "what works for whom?" (Fonagy et al., 2015). Different approaches to responding to this question have been adopted: some studies have taken a microanalytical approach based on the psychophysiological responses of therapists and patients (Steffen et al., 2014; Kleinbub, 2017), while others have analyzed the impact of therapist empathy and challenge on psychophysiological responses from patients (Voutilainen et al., 2018).

From a mixed methods perspective this question can be addressed by analyzing communication and therapeutic discourse interactions using an *ad hoc* observation instrument (Arias-Pujol et al., 2015; Arias-Pujol and Anguera, 2017; Del Giacco et al., 2019, 2020). Conversation and the therapeutic alliance are essential components of psychoanalytic therapy (Manzano et al., 2018). In the case of adolescents, creating a therapeutic alliance is crucial to preventing therapy dropout (O'Keefe et al., 2018). As the therapy unfolds, an alliance is formed between the therapist and participants (Tanzilli et al., 2018) that allows the therapist to communicate increasingly complex content concerning the here-and-now of the sessions. In the early stages of therapy, this intrapsychic content may not be understood by the patient, and might even lead to resistance, especially in adolescents (Oetzel and Scherer, 2003; Lavik et al., 2017, 2018); it can only emerge once a climate of trust has been created (Sagen et al., 2013). Interventions of this type are aimed at increasing the patient's capacity for mentalization, which is a process by which people make sense of themselves and each other (Fonagy, 1991). In group sessions, therapist interventions designed to build capacity for mentalization show that behaviors are motivated by emotions, thoughts, fantasies, and wishes. Although it is recognized that everybody has their own mind, the group participants come to see the benefits of sharing points of view and empathizing with other people's experiences (Torras de Beà, 2013). A previous study by our group (Arias-Pujol and Anguera, 2017) that analyzed conversation turn-taking in adolescent group therapy showed that four main roles were played by the lead therapist: (1) she did not facilitate interventions by all group members uniformly, (2) she encouraged turn-taking from more inhibited participants, (3) she facilitated conversation from the early stages of therapy, and (4) she promoted the capacity to mentalize toward the end of therapy.

The aim of this new study, conducted within a mixed methods framework, was to investigate potential differences in

the communication strategies used by a lead therapist in earlier and later stages of therapy. The specific aim was to use T-pattern detection, lag sequential analysis, and polar coordinate analysis to detect changes in the communication flow between a lead therapist and her patients (in this case, adolescents), analyzing the specific techniques used and their impact on the therapist-patient relationship.

MATERIALS AND METHODS

Design

The specific design was nomothetic/follow-up/multidimensional (N/F/M) (Anguera et al., 2001; Sánchez-Algarra and Anguera, 2013). It was nomothetic because we observed different participants (lead therapist, co-therapist, and group members), follow-up because we analyzed two sessions and their content (one session each from the beginning and the end of the therapy), and multidimensional because we analyzed 15 communication strategy dimensions using an *ad hoc* observation instrument (Arias-Pujol and Anguera, 2017). Both direct observation (Sánchez-Algarra and Anguera, 2013) and indirect observation (Anguera et al., 2018) techniques were used. The observation was participative, given that the psychotherapist interacted with the adolescents. The recommendations of the *Guidelines for Reporting Evaluations based on Observational Methodology* (GREOM) (Portell et al., 2015) and the *Methodological Quality Checklist for Studies based on Observational Methodology* (MQCOM) (Chacón-Moscoso et al., 2019) were followed.

Participants

The group therapy sessions were conducted in the Eulàlia Torras de Beà Foundation (FETB) Center for Child and Adolescent Mental Health (Barcelona, Spain) with six adolescents (four boys and two girls) aged 13–15 years, an expert lead therapist, and a co-therapist. All the adolescents had difficulties with learning and interpersonal relationships.

This research forms part of a broader project involving an 8-month intervention developed to enhance the mentalization and communication capacities of adolescents, whose parents attended parallel sessions on parenting. The goal of the therapists was to facilitate interaction among all the group members by creating an atmosphere of emotional security and support (Torras de Beà, 2013).

Written informed consent was obtained from the parents of the minors in accordance with the principles of the Declaration of Helsinki and the Ethical Code of the General Council of the Spanish Official College of Psychologists. Approval by an ethics committee was not required as per applicable institutional and national guidelines and regulations. The participants were informed that they were being filmed and agreed accordingly, and were shown the location of the video cameras, positioned discretely to minimize reactivity bias. They were guaranteed that their identity and privacy would be protected at all times. For this, pseudonyms were used in the transcripts and encodings of the material. The study was approved by the head of the Eulàlia Torras de Beà Foundation (FETB) Research Department. Regulatory provisions regarding clinical research in humans of the European Union (Good Clinical Practice for Trials on Medicinal Products in the European Community: EEC 111/3976/88-EN) and of Spain (Royal Decree 561/1993) were applied.

Instruments

Observation Instrument

The observation instrument, developed *ad hoc* for a previous study, combined field format and several category systems (Arias-Pujol and Anguera, 2017). The category systems were built on 15 dimensions proposed for analysis of communication strategies. A category system was built from each dimension (except for some single-category dimensions) that fulfilled the requirements of exhaustiveness and mutual exclusivity. The 'turn' dimension was observed directly, while the other 14 dimensions were observed indirectly. A total of 28 categories resulted for the dimensions (**Table 1**).

Recording and Analysis Instruments

The recording instrument used was the freeware GSEQ5, v.5.2[1] (Bakeman and Quera, 1996, 2011), which allowed the sessions to be coded in accordance with the observation instrument. The obtained data were type II data (Bakeman, 1978), and, therefore, concurrent and event-based. GSEQ5 was also used to calculate agreement.

Regarding the analyses, T-patterns were detected using the freeware THEME v.6 Edu[2] (Magnusson, 1996, 2000, 2020), lag sequential analysis was performed using GSEQ5, polar coordinates were analyzed using the freeware[3] HOISAN v. 1.6.3.3.6. (Hernández-Mendo et al., 2012), and vectors were graphed using R (Rodríguez-Medina et al., 2019).

Procedure

This research was part of a group psychotherapy program consisting of 30 sessions, 24 of which were transcribed to capture conversation turn-taking. To delimit the observation unit, we used interlocutor and syntactic criteria in a complementary manner (Anguera, in press; Krippendorff, 2013). As mentioned, the data were type II data (Bakeman, 1978), which materialize code matrices as obtained in the quantitizing process; these qualitative data from the recording (see vignettes in **Tables 2**, **3**) were systematized through observation-instrument coding and computerized recording. The code matrices contain rows (a separate row for each observation unit) that show the codes for co-occurrences of simultaneous behaviors for the different dimensions of the observation instrument. Quantitizing is crucial in the mixed methods framework (Anguera et al., 2017a; Anguera, 2020; Anguera et al., in press), as it enables access to the second QUAL-QUAN-QUAL phase; the fact that the code matrices are quantitatively analyzed allows for the crucial step that connects functions

[1]https://www.mangold-international.com/en/products/software/gseq

[2]www.patternvision.com

[3]www.menpas.com

TABLE 1 | Dimensions and category systems in the observation instrument for therapists and patients (adapted from Arias-Pujol and Anguera (2017).

Dimension and category systems	Description
Dimension DYN **Facilitating conversation** Categories: FF, FO, RP, RT, QA, QC, and QV	**Facilitating conversation**. Suitable questions or requests to start or enhance dialogue; routines such as greetings and other conversational rituals; requests for clarification; verification questions; full or partial repetitions of a previous intervention in the form of a statement or a question; vocalizations indicating that the communication channel is still open. **FF** = Phatic function. Vocalization indicating that the communication channel is still open. It indicates continued attention and cooperation, without the addition of new information. Typical vocalizations are "hmmn," "hum," or "aha." **FO** = Conversational routines or rituals, such as greetings or expressions of gratitude. **RP** = Paraphrasing. Total or partial reproduction of a previous utterance in the form of a statement not a question. This could be an answer to a request for clarification or it could have a phatic function, such as, for example, when the speaker simply echoes what a person has just said, indirectly encouraging them to continue. **RT** = Bringing back a topic of conversation. Intervention in which a participant brings back a subject previously brought up by another participant after a change of subject (CT) or interruption, thus making sure it is not forgotten. **QA** = Questioning. Request, expressive question, or series of adequate questions to start or promote dialogue and keep the main topic of conversation flowing. The person gives the turn to another person and shows interest in them. **QC** = Clarifying question. Question asking for clarification about what is happening. The person intervenes to clarify their own confusion and/or surprise in the form of a question. The speaker asks about a particular topic, doubt, or puzzlement, or about expressions, gestures, noises, or laughter he/she has not understood. It is a strategy used by the therapist when the adolescents are "doing their own thing." **QV** = Repetition of a previous statement in the form of a question. It is used to confirm what has just been said. It has a phatic function, as the speaker is conveying that the communication channel is still open. It can also be a strategy to emphasize a particular word or intervention.
Dimension **Mentalization**: MNT	**Mentalization** **MNT** = Interventions focused on promoting thought, reflection, and understanding of oneself and one's relationships with others. They seek to stimulate the ability to understand what is happening in the minds of others. They are used by the therapist and can be directed at an individual or at the group as a whole. They include emphatic interventions, which put words to other participants' feelings.
Dimension **Expressivity** Categories: RA, EC, CD, and RB	**Expressivity.** Interventions and answers manifesting the thoughts and/or feelings of the person speaking, the conversation flows. **RA** = Interventions that answer a question. **RP** = short answer: yes or no. **EC** = sequences of words that continue the main subject of conversation; it is not an answer. **CD** = Interventions that give a new approach to the same subject.
Dimension **Defensive** categories: RD_N_P and CT	**Defensive expressions** **RD_N_P** = Interventions in which the participant avoids answering a previous question; verbalizations expressing the opposite of what has been said or done; projection of conflicts onto others. **CT** = changing subject.
Dimension **Dislike** categories: ED and PD	**Dislike** **ED** = Interventions expressing dislike, disagreement, or distaste. **PD** = Interventions expressing defiance.
Dimension **Ordering**: ORD	**Ordering.** **ORD** = Prescriptive verbalizations, authoritarian demands (including exclamations).
Dimension **Humor** categories: R and EO	**Humor** **EO** = Interventions with a clearly ironic/wry intention, jokes, jibes. **R** = laughter.
Dimension **Confrontation**: CFR	**Confrontation** **CFR** = Verbal interventions used by participants to express what they feel is happening in the group or see in some of their peers. They mirror the behavior of another.
Dimension **Exclamation**: EX	**Exclamation** **EX** = Onomatopoeic word or words indicating a strong emotion of surprise, joy, or sadness.
Dimension **Degradation of vocal behavior**: S4	**Degradation of vocal behavior** **S4** = Failed spontaneous interventions, interventions that progressively become weaker, abandoning turn.
Dimension **Whispering**: S5	**Whispering** **S5** = Talking in a low voice, with the intention of being heard by only a few people, establishing complicity. It leads to confused murmuring.
Dimension **Touching**: TO	**Touching** **TO** = Intentional physical contact with another person.

(Continued)

TABLE 1 | Continued

Dimension and category systems	Description
Dimension **Noise** categories: MO, S2, and S3	**Noise.** Noise or noises produced: **S2** = by a person, through their body (e.g., sneezing, burping, and clapping) **S3** = interaction with an object (e.g., chair, table, and wall). **MO** = movement.
Dimension **Surrounding noise:** S1	**Surrounding noise** **S** = Sounds from outside the therapy room that are loud enough to be clearly heard.
Dimension **Silence**: Q	**Silence.** **Q** = No words. Indicates no behavior.
Dimension **Turn:** Turn	**T =** Lead therapist. **coT =** Co-therapist. **G =** Gabriel (pseudonym). **D =** Danny (pseudonym). **JM =** John M. (pseudonym). **F =** Fred (pseudonym). **L =** Lucy (pseudonym). **M =** Megan (pseudonym). *Pseudonyms have been used to protect confidentiality.*

TABLE 2 | Sample clinical vignette for the initial session.

Although this session was session 5 in the group psychotherapy program, it was the first one held with all the participants.

The lead therapist (T) plays a very active role, encouraging participation so that the adolescents can get to know each other. She asks them about their names, ages, hobbies, how they get to the therapy sessions, what expectations they have about the group, what they like, and what annoys them. They contribute by talking about their experiences with teachers, classmates, and out-of-school activities.

Example:

T- What about you, Megan? (QA)

M- Well, the girls in my class, they go together to a corner (of the shopping center)... (RA)

T- To a corner (RP)

Laughter (R)

M- A corner... (EC)

T-Hmm (FF)

M- And they start smoking, they smoke, drink... (EC)

T- They smoke and drink (RP)

M- Some of them, yes, they do... (EC)

G- Well, then, I'm going there too! (EC)

Laughter (R).

TABLE 3 | Sample clinical vignette for the final session.

Everyone is present in this session and they chat as they enter the office from the waiting room. The dialogue is fluid with a lot of joking and laughing. The participants talk about the end of the therapy and the school year. The lead therapist (T) wants to know their opinions about the experience and highlights the changes that have occurred. Many conversations are interrupted by jokes and changes of subject. T tolerates this, comments that they have got to know each other, and that it is now hard to say goodbye.

Example:

G notices L's shoes and they start talking about the size of their shoes and compare them with the T's shoes. They then look at the size of their hands.

T- You are noticing your changes, the changes in others, and in the end this is how you see yourselves, how the others see you, whether you like yourselves or not... (MNT)

L- If we have liked ourselves here? (QA)

G- Yes (RB)

T- Also here... I imagine that everyone is thinking: what do they think of me, how do they see me, what image of me am I giving? (MNT)

G- Ugly! (EO)

They all laugh (R)

D (talking to G) – Bad imitation of your father, your grandfather... (CFR)

G (going on with the joke) – great-grandfather... (EO)

M (talking to F who is chewing on a part of his sweater) – Hey, sweater taste good? (EE QA)

Amidst jokes, touching, and laughter, they then start to talk about things people do when they are nervous. L bites her nails, G chews on a pen, D can't stop moving his legs...

T- These are things that you say to each other, that you see in yourselves and in others. (MNT).

and that permits the integration of qualitative and quantitative elements (Plano Clark and Sanders, 2015), in such a way that initially qualitative data can be analyzed quantitatively (Anguera et al., 2018).

The reliability of the data was confirmed by calculating Cohen (1960, 1968); the obtained values of between 0.897 and 0.939, according to Landis and Koch (1977, p. 165), can be interpreted as "almost perfect agreement".

Data Analysis

For the current study, we compared the content of two sessions in order to showcase an innovative methodological development in group psychotherapy in which qualitative records from the two sessions underwent a powerful quantitative analysis within a mixed methods framework.

The first session was an early session (session 5, the first with the full group), while the second one was a session from the end of therapy (session 29, held 7 months later, just before the farewell/end-of-treatment session). Once the data had been validated and transformed into code matrices, sessions 5 and

29 were analyzed in depth using three scientifically grounded and specific categorical data techniques: T-pattern detection, lag sequential analysis, and polar coordinate analysis (with the therapist as the focal subject). These quantitative techniques are highly appropriate for the analysis of qualitative data collected by direct observation (Anguera et al., 2017b) and indirect observation (Anguera et al., 2018) and suitably organized in code matrices within the framework of a mixed methods study (Anguera et al., in press). To date, the three techniques have been applied in combination in the fields of education (Santoyo et al., 2017; Escolano-Pérez et al., 2019) and sport (Tarragó et al., 2017).

T-pattern detection

T-pattern detection was proposed and developed by Magnusson (1996, 2000, 2005, 2016, 2018, 2020). T-patterns, or temporal patterns, are essentially a combination of events that occur in the same order, separated by temporal distances that remain invariant over time. The basic premise of T-pattern detection is that the interactive flow or chain of behaviors consists of structures of variable stability that can be visualized through the detection of underlying T-patterns (Suárez et al., 2018; Portell et al., 2019; Santoyo et al., 2020). As indicated by Magnusson (2020, p. 2): "As a Mixed Methods approach, T-pattern analysis [. . .] passes repeatedly between qualitative and quantitative analyses, from data collection logging the occurrences of qualities (categories) and their real-time (quantitative) locations resulting in time-stamped data, here T-data, to the detection of T-patterns (qualities) [. . .], typically followed by both qualitative and quantitative analyses of the detected patterns." T-pattern analysis involves the use of an algorithm that calculates temporal distances between codes of behaviors, analyzing the extent to which the critical interval remains invariant relative to the null hypothesis. It requires the use of systematized data (usually in the form of code matrices) for which the duration of each co-occurrence has been recorded (Anguera et al., 2018). As indicated by Magnusson (1996, 2000, 2020), a T-pattern, Q, consists of m ordered components, $X_{1...m}$, that are recurrent, where each temporal co-occurrence of behaviors (called event-types) is a T-data. A T-pattern can be characterized as follows, considering variations in distances between consecutive behaviors (Magnusson, 2020):

$$Q = X_1\ [d_1,d_2]_1\ X_2\ [d_1,d_2]_2.\ X_i\ [d_1,d_2]_i\ X_{i+1}.\ X_{m-1}\ [d_1,d_2]_{(m-1)}\ X_m,$$

where X is an event-type or a T-pattern. The general term $X_i\ [d_1, d_2]i\ X_{i+1}$ means that, within occurrences of the pattern, after X_i occurring at t statistically significantly more often than expected by chance, X_{i+1} occurs within interval $[t + d_1, t + d_2]$, or short $[d_1, d_2]$, called a critical interval (Anguera et al., in press).

Microanalyses are also possible and very useful (Anguera, 2005). These analyses are run in THEME v. 6 Edu, which offers different settings that can be modified to obtain complementary results. Combined analysis of these results can provide a better understanding of interactive transitions over time. THEME provides all the necessary features to analyze the data and presents the results graphically as dendrograms or tree diagrams.

Two parameters necessary for each analysis are the minimum number of occurrences and the level of significance. We set the minimum number of occurrences to 30 and the significance level to $p < 0.005$. Note that the method applied in this research was rather unconventional, as the temporal distance parameter was set to 1 in all cases. This method was chosen because of the nature of the data (type II).

While T-pattern detection has been used in a wide range of fields, including clinical psychology (Blanchet et al., 2005; Haynal-Reymond et al., 2005; Merten and Schwab, 2005; Plumet and Tardif, 2005; Horn and Magnusson, 2016; Woods et al., 2016), its application to group therapy with adolescents is novel.

Lag sequential analysis

This technique, proposed by Bakeman (1978), aims to detect the existence of patterns of behavior within categorical data corresponding to regular behaviors that are not due to random effects. Lag sequential analysis one or more given behaviors (any that, by hypothesis, are assumed to generate or initialize a behavior pattern), one or more conditional behaviors (for which we wish to test the existence of a statistical association with a given behavior), and lags (positive, negative, or both). Behaviors with positive and negative lags occur after and before the given behavior, respectively. The number of the lag indicates the order in which it occurs.

Lag sequential analysis can operate with five types of data: event sequence data, state sequence data, timed state sequence data, interval sequence data, and multi-event sequence data. The first four were designated by Bakeman (1978) and were later slightly modified by Bakeman and Quera (1996, 2011) when building the SDIS-GSEQ software (precursor of the current GSEQ5). A minimum of 30 data items (30 code matrix rows) is required for the results to be valid (Bakeman and Gottman, 1987). Since lag sequential analysis works with code matrices (Anguera et al., 2018), it can be used to detect regularities (patterns of behavior) that show the structure of interactive episodes (Bakeman, 1978, 1991; Bakeman and Gottman, 1987; Bakeman and Quera, 1996, 2011; Quera, 2018); this is very useful in clinical psychology, especially when we want to detect regularities at different points in time.

Once the conditional behaviors and lags of interest have been defined, as per Bakeman (1978), a matching frequencies table based on the gicen behavior is generated and this is then used to generate a probability table showing expected and conditional probabilities. Expected probabilities indicate the extent of random effects, while conditional probabilities provide the residual values that indicate whether or not the relationship with the given behavior is significant that at each lag. It is recommended to apply the adjustment proposed by Allison and Liker (1982), incorporated in SDIS-GSEQ, as it expresses the results as adjusted residuals.

Once the adjusted residuals have been obtained, the pattern (or patterns) of behavior is (are) "constructed," starting with the proposed criterion behavior in each case. Each lag (whether positive or negative) will include the conditional behavior(s) with a significant adjusted residual value: >1.96 when the relationship

is activation and <-1.96 when the relationship is inhibition (for a significance level of $p < 0.05$).

So that researchers can consider where the structure conventionally ends, i.e., to end the interpretation purposes of the obtained structure, interpretation guidelines should be applied (a) when there are no more lags with statistically significant behaviors, (b) when there are two consecutive empty lags, or (c) when there are several statistically significant behaviors in two consecutive lags and the first of the lags is considered the MAX LAG (Anguera et al., in press; Sackett, 1979).

Lag sequential analysis can be applied, in both direct and indirect observation, to a complete session, part of a session, parts of different sessions (e.g., the first few minutes of a series of sessions), or series of complete sessions. It therefore offers enormous flexibility in addressing different research questions. It requires data for which the sequence of occurrence of concurrent behaviors has been recorded and it can be run in any of the following programs: GSEQ5 v. 5.2 (Bakeman and Quera, 2011) and GSEQ5 (Bakeman and Quera, 2011), which allow various simultaneous criterion behaviors, or HOISAN v. 1.6.3.3 (Hernández-Mendo et al., 2012), which only allows one criterion behavior.

Lag sequential analysis has been successfully applied in many direct and indirect observation studies conducted over the past 25 years in clinical psychology (e.g., Martínez del Pozo, 1993; Arias-Pujol and Anguera, 2004, Arias-Pujol and Anguera, 2005; Roustan et al., 2013; Arias-Pujol et al., 2015; Venturella et al., 2019; Del Giacco et al., 2020).

Polar coordinate analysis

Polar coordinate analysis, an analytical technique proposed by Sackett (1980), is based on building a map that shows the statistical association between different behavior codes, and specifically between a behavior that is considered central or core, called the focal behavior, and all other behaviors, called conditional behaviors. The goal is to determine if there is a relationship, and if there is one, its type and intensity. This technique, which considers as data the adjusted residuals obtained in the lag sequential analysis, complements the prospective (forward feeding) and retrospective (backward feeding) perspectives, allowing us to observe how the relationship between focal behavior and conditional behaviors evolves over time. This analysis is therefore based on prospective and retrospective perspectives. Sackett (1980) applied Bakeman's (1978) concept of prospectivity, but considered retrospective lags feeding forward from negative lags, going from a lag of -5 to a lag of -4, from -4 to -3, and so on successively, in an approach open to criticism. Anguera (1997) proposed a promising new concept, called genuine retrospectivity – included in the analysis algorithm on programming the HOISAN software – that allows backward feeding, from lag 0 to -1, from lag -1 to -2, and so on (Gorospe and Anguera, 2000; Gorospe et al., 2005).

Sackett (1980) ingeniously used the Z_{sum} statistic proposed by Cochran (1954), providing a powerful means of data reduction provided the data are independent. He applied it to the obtained adjusted residual values (which are independent of each other because they each respond to a different calculation given that the lags are different) considering the criterion behavior of the sequential analysis as the focal behavior and the conditional behaviors in positive lags to obtain the prospective Z_{sum} values. He applied the same method (but using conditional behaviors in negative rather than positive lags) to obtain the retrospective Z_{sum} values. Note that the number of positive and negative lags must be the same (Sackett, 1980). Experience to date (Sackett, 1979; Anguera and Losada, 1999) indicates that at least five prospective (e.g., lags +1 to +5) and five retrospective lags (e.g., -1 to -5) to be analyzed (Anguera et al., 2018).

From the prospective and retrospective Z_{sum} values, Sackett (1980) proposed a vectorialization of the relationships between focal behavior and conditional behaviors. Each vector has length or radius $Length = \sqrt{(Z_{sum\ \text{prospective}})^2 + (Z_{sum\ \text{retrospective}})^2}$ and an angle $\phi = Arc\ \text{sen}\ \frac{Z_{sum\ \text{retrospective}}}{\text{Length}}$.

As many vectors as conditional behaviors are obtained, all graphically with their origins in the focal behavior. Because the prospective and retrospective Z_{sum} values have a positive or negative sign, the corresponding vectors can be plotted such that the prospective and retrospective values will be displayed along the horizontal (X)-axis and the vertical (Y)-axis, respectively.

The meaning of the vectors varies in function of the quadrant in which they are located, and the position of a vector in one quadrant or another is determined by the combination of positive or negative signs on the prospective and retrospective Z_{sum} values:

Quadrant I (+ +): the focal and conditional behaviors activate each other.

Quadrant II ($-$ +): the focal behavior inhibits and is activated by the conditional behavior.

Quadrant III ($-$ $-$): the focal and conditional behaviors inhibit each other.

Quadrant IV (+ $-$): The focal behavior activates and is inhibited by the conditional behavior. Vector length indicates the strength (statistical significance) of the association between the focal and conditional behaviors.

Like T-pattern detection, polar coordinate analysis has been used in a wide range of fields, including clinical psychology (Arias-Pujol and Anguera, 2017; Rodríguez-Medina et al., 2018; Alcover et al., 2019; Del Giacco et al., 2020).

RESULTS

The way in which the therapist and the adolescents communicated with each other changed from session 5 to 29 and the qualitative changes detected were confirmed quantitatively within a rigorous analytical framework. Sample clinical vignettes for each session are reproduced below.

Tables 4A,B shows the records corresponding to the vignettes in **Tables 2**, **3** for multi-event sequence data and according to the syntax of the GSEQ5 program. These data make up an .SDS file, compiled for the program to check for formal errors and generating an .MDS file once verified as correct.

The results of the three techniques (T-pattern detection, lag sequential analysis, and polar coordinate analysis) are presented below.

TABLE 4 | Fragment of record with multi-event sequence data using the syntaxis of the GSEQ5 program.

(A) Session 5	(B) Session 29
Multi-event	Multi-event
($HUM = R EO)	($HUM = R EO)
($DIS = ED PD)	($DIS = ED PD)
($NOI = MO S1 S2 S3)	($NOI = MO S1 S2 S3)
($TO = TO)	($TO = TO)
($EX = EE)	($EX = EE)
($WHI = S5)	($WHI = S5)
($ORD = DO)	($ORD = DO)
($DIN = QA QACL FF FO RP PV RT)	($DIN = QA QACL FF FO RP PV RT)
($MNT = MNT)	($MNT = MNT)
($CFR = CFR)	($CFR = CFR)
($EXP = RA EC CD RB)	($EXP = RA EC CD RB)
($DEF = RD_N_P CT)	($DEF = RD_N_P CT)
($Q = Q)	($Q = Q)
($TURN = O G D JM F L M);	($TURN = O G D JM F L M);
T QA.	T MNT.
M RA.	L QA.
T RP.	G RB.
R.	T MNT.
M EC.	G EO.
T FF.	R.
M EC.	D CFR.
T RP.	G EO.
M EC.	M QA.
G EC.	T MNT/
R/	

(A) *Corresponding to session 5 (vignette from* ***Table 2****), and* ***(B)*** *corresponding to session 29 (vignette from* ***Table 3****). The first part contains, according to the syntax of the GSEQ program, the data type and the code declarations corresponding to the observation instrument.*

T-Pattern Detection

For both sessions, the records obtained were transformed using the GSEQ5 program to adapt them to the syntax of the THEME program, which requires two files: the VVT.VVT file corresponding to the observation instrument, and the .RDT file corresponding to the recorded data. **Tables 5A–C** shows the VVT.VVT file and the respective records corresponding to the vignettes in **Tables 2**, **3**, maintaining a conventional and constant distance according to the THEME syntax.

For the initial sesión (see **Figure 1**), we detected four T-patterns for the therapist as focal subject. These were related to two communication modalities: questioning (code QA) and repetition or paraphrasing (code RP).

For the final sesión (see **Figure 2**), we detected two T-patterns, again related to two communication modalities: questioning (QA) and mentalization (MNT).

Lag Sequential Analysis

For both sessions, sequential lag analysis was performed considering T as the criterion behavior and all other observation instrument codes as conditional behaviors. **Table 6** shows the adjusted residual values obtained using the GSEQ5 program.

TABLE 5 | Fragment of record using the syntaxis of the THEME program.

(A) VVT.VVT file	(B) .RDT file (Session 5)		(C) .RDT file (Session 29)	
HUM	Time	Event	Time	Event
R	5	:	5	:
EO	10	T,QA	10	T,MNT
DIS	15	M,RA	15	L,QA
ED	20	T,RP	20	G,RB
PD	25	R	25	T,MNT
NOI	30	M,EC	30	G,EO
MO	35	T,FF	35	R
S1	40	M,EC	40	D,CFR
S2	45	T,RP	45	G,EO
S3	50	M,EC	50	M,QA
TO	55	G,EC	55	T,MNT
TO	60	R	60	&
EX	65	&		
EE				
WHI				
S5				
ORD				
DO				
DIN				
QA				
QACL				
FF				
FO				
RP				
PV				
RT				
MNT				
MNT				
CFR				
CFR				
EXP				
RA				
EC				
CD				
RB				
DEF				
RD_N_P				
CT				
Q				
Q				
TURN				
O				
G				
D				
JM				
F				
L				
M				

(A) *VVT.VVT file corresponding to the observation instrument,* ***(B)*** *.RDT file corresponding to session 5 (vignette from* ***Table 2****), and* ***(C)*** *.RDT file corresponding to session 29 (vignette from* ***Table 3****).*

Sequential lag analysis of the data from session 5 revealed a behavioral pattern in which paraphrasing and use of questioning alternated between lags −3 and +2. A sequential

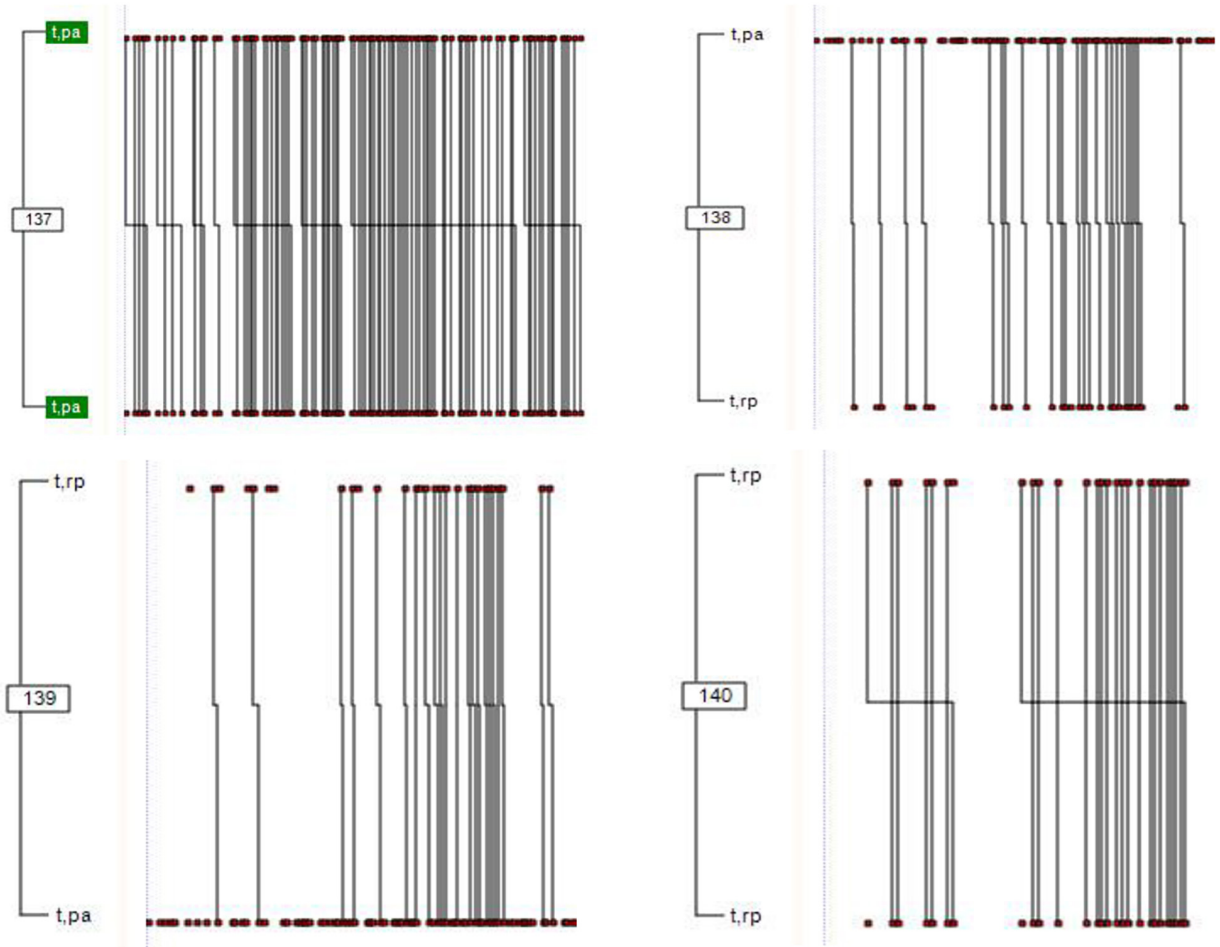

FIGURE 1 | T-patterns in the initial session: minimum occurrence 30 and $p < 0.005$. Four T-patterns were identified linking turn-taking by the therapist to the questioning (QA, depicted as PA in the graph) and repetition/paraphrasing (RP) categories (both from the "facilitating conversation" dimension). The vertical lines correspond to each co-occurrence of *t* and *pa* behaviors (patterns 137 and 138), followed by co-occurrences of *t* and *pa* (pattern 137) and *t* and *rp* (pattern 138). The vertical lines also show co-occurrences of *t* and *rp* (patterns 139 and 140) followed *t* and *pa* (pattern 139), and *t* and *rp* (pattern 140). The length of the horizontal line fragments is proportional to their duration.

pattern with mentalization located in the center (lag 0) was detected for session 29.

Polar Coordinate Analysis

Obtained, considering T as the focal behavior and all other observation instrument codes as conditional behaviors, were parameters corresponding to the prospective and retrospective Z_{sum} values, from which vector length and angle values were calculated along with the quadrant in which the values were located. All values were obtained using HOISAN.

Tables 7, **8** show the parameters corresponding to sessions 5 and 29, respectively.

Graphs of the vectors, created using R, are depicted in **Figures 3**, **4**.

The polar coordinate analysis showed that the therapist activated questioning and paraphrasing (quadrant I) in the initial session, and questioning and mentalization in the final session (quadrant I).

DISCUSSION

The results obtained in the T-pattern, lag sequential, and polar coordinate, analyses all show changes in the conversation-facilitation techniques used by the lead therapist from the start to the end of therapy. Although the combination of these three techniques has been used in different fields (e.g., Santoyo et al., 2017; Tarragó et al., 2017), this is the first time they have been applied in combination to clinical psychology. Our findings show that this is a remarkably productive approach to identifying relationships between communication modalities and changes that occur during the therapeutic process.

From the observation instrument composed of 15 dimensions and 28 categories (**Table 1**), three communication modalities in particular were identified – questions (QA), paraphrasing (RP), and mentalization (MNT) – suggesting that these are all powerful communication strategies for encouraging patient interaction in group therapy (Oetzel and Scherer, 2003).

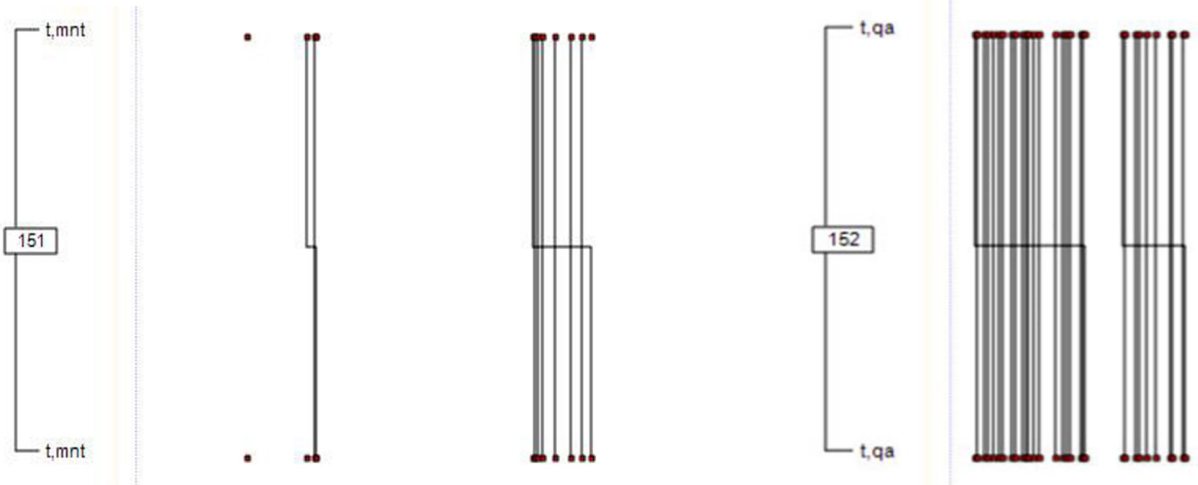

FIGURE 2 | T-patterns in the final session: minimum occurrence 30 and $p < 0.005$. Two T-patterns were identified. One was linked to the turn-taking of the therapist in the mentalization (MNT) category (from the "mentalization" dimension), and the other was linked to the questioning (QA) category (from the "facilitating conversation" dimension). Vertical lines reflect co-occurrences of *t* and *mnt* (pattern 151) and *t* and *qa* (pattern 152) behaviors, followed by co-occurrences of *t* and *mnt* (pattern 151), and *t* and *qa* (pattern 152) behaviors. The length of the horizontal line fragments is proportional to their duration.

TABLE 6 | Lag sequential analysis for the initial and final sessions, 5 and 29, respectively.

Session	Lag −3	Lag −2	Lag −1	Lag 0	Lag +1	Lag +2
Initial (5)	RP (2.13)	QA (4.52)	RP (9.22) MNT (3.34)	–	QA (4.78)	RP (4.24)
Final (29)	MNT (3.45)		RP (3.52)	MNT (8.52)	QA (2.83)	

T (therapist) is the given behavior. RP indicates paraphrasing, QA, questioning, and MNT, mentalization. Numbers in parenthesis mean adjusted residual values (see Lag sequential analysis subsection).

TABLE 7 | Parameters corresponding to the prospective and retrospective Z_{sum} values obtained in session 5, considering T (therapist) as the focal behavior, from which vector length, vector angle, and quadrant were calculated.

Code	Quadrant	Prospective Z_{sum}	Retrospective Z_{sum}	Length vector	Angle vector
QA (facilitating conversation)	I	2.28	0.44	2.33(*)	10.97
RP (facilitating conversation)	I	2.69	4.23	5.01(*)	57.51
MNT (mentalization)	III	−1.76	−0.45	1.81	194.25

** means that vector is significative (>1,96).*

TABLE 8 | Parameters corresponding to the prospective and retrospective Z_{sum} values obtained in session 29, considering T (therapist) as the focal behavior, from which vector length, vector angle, and quadrant were calculated.

Code	Quadrant	Prospective Z_{sum}	Retrospective Z_{sum}	Length vector	Angle vector
QA (facilitating conversation)	I	5.23	2.85	5.95(*)	28.56
RP (facilitating conversation)	IV	0.4	−0.26	0.48	326.74
MNT (mentalization)	III	4.38	6.13	7.54(*)	54.45

** means that vector is significative (>1,96).*

Questioning by the therapist was observed in both the earlier and later sessions and its use shows that the therapist expressed interest in what the participants had to say, strengthening the therapist-patient bond. Questioning stimulates dialogue and encourages more inhibited group members to take the floor in a conversation and to express their experiences and feelings.

Paraphrasing was a particularly common strategy used in the initial session. Repeating what someone has said is a common technique for facilitating communication; it shows active listening and interest on the part of the therapist and facilitates an atmosphere of empathy and acceptance. This result corroborates the importance attached to reciprocity by

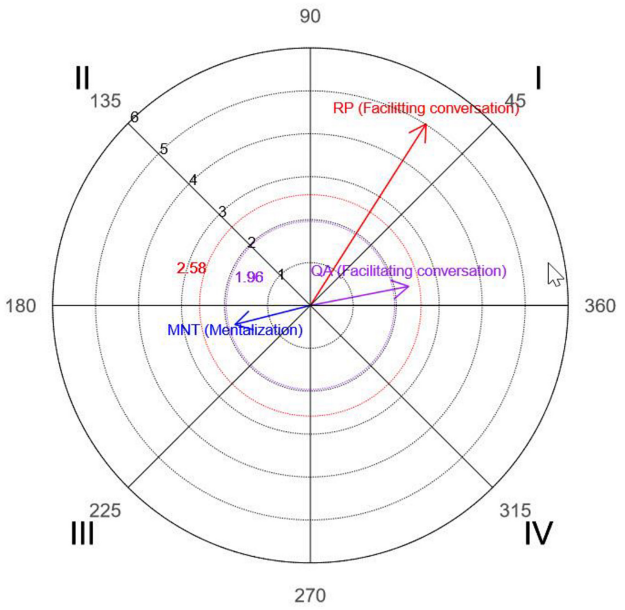

FIGURE 3 | Polar coordinates for the initial session. The vectors correspond to interventions by the therapist (T) as focal behaviors and the communication strategies questioning (QA), paraphrasing (RP), and mentalization (MNT) as conditional behaviors.

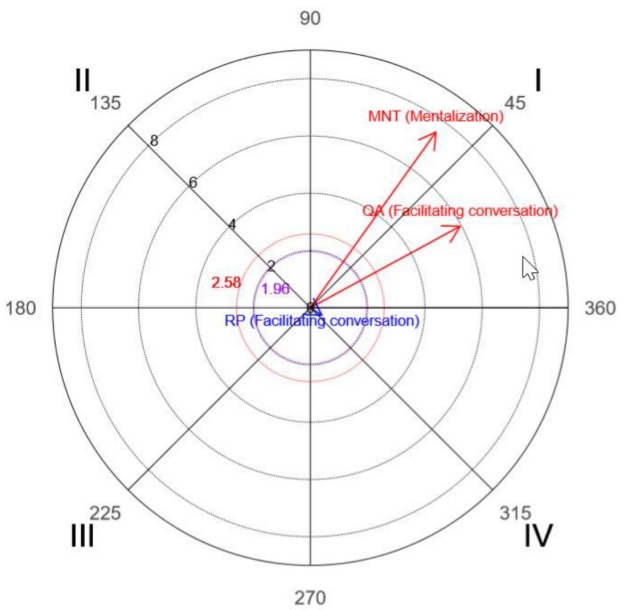

FIGURE 4 | Polar coordinates for the final session. The vectors correspond to interventions by the therapist (T) as focal behaviors and the communication modalities questioning (QA), paraphrasing (RP), and mentalization (MNT) as conditional behaviors.

adolescents as reported by Lavik et al. (2018). By repeating what the adolescent has just said, the therapist gives them the chance to continue talking ad treats them as an equal. In a sense, it constitutes a verbal reflection or "mirroring" of the speaker's expressiveness that serves to hold attention and stimulate. Our findings, however, show that the therapist did not use this technique frequently, as it accounted for just 10% of her interventions, compared with 25% for questioning. The remaining 65% of interventions comprised a highly variable presence of the other 14 categories. Questioning and paraphrasing, both common strategies in psychotherapy, form part of the "facilitating conversation" dimension of the study observation instrument (**Table 1**).

Mentalization appeared in the final session, reflecting the communicative maturity of the group. In a previous study by our group, we found that paraphrasing was used to activate conversation from the early stages of therapy and also that it encouraged the emergence of mentalization (Arias-Pujol and Anguera, 2017). The results of the present study support this regulatory effect of paraphrasing as a prior requirement for the mentalization process (Fonagy et al., 2002); demonstrated is its relationship with the reflection or mirroring effect, while affect regulation and mentalization are linked to the development of self (Fonagy et al., 2018). In terms of the distinction between empathy with patients and challenging of their judgments by therapists, as described by Voutilainen et al. (2018), we saw that interventions designed to stimulate mentalization posed a true challenge to the adolescents in our group, who were found to "defend themselves" from this process, resorting to jokes and noises, touching, playful or more forceful hitting, laughter, and changes of subject. The therapist attempted to contain these emotions by non-judgmental interventions and by encouraging the adolescents to express themselves. The results suggest that a certain level of empathy and acceptance is necessary in psychotherapy to create an environment in which the therapist's challenges are heeded and contribute to personal growth (Karver et al., 2006; Binder et al., 2011; Sagen et al., 2013).

From the clinical perspective, our results provide objective evidence, supported by three different analytical methods, of the important use that a therapist makes of three of the 28 communication strategies in the observation instrument, namely, questioning, repetition/paraphrasing, and interventions to improve mentalization. Unlike our previous study, which focused on differences in turn-taking in group sessions, this study focuses on differences in early and late communication strategies of the therapist. Our findings show how use of the different communication strategies varies from early to late therapy stages. In terms of novel findings, all three analytical methods detected a statistically significant increase in the use of questioning and repetition/paraphrasing as "conversation facilitators" in the early stages of therapy. In previous study (Arias-Pujol and Anguera, 2017), these strategies were grouped into a single block — conversation-facilitating DYN categories — formed by seven codes (FF, FO, RP, RT, QA, QC, and QV). A second novel finding, detected again by all three methods, was that the therapist made significantly greater use of questioning and mentalization in the later session compared to the earlier session to achieve the goals of the intervention.

This mixed methods study employed systematic observation and a succession of QUAL-QUAN-QUAL stages. We have shown that the combined use of T-pattern detection, polar coordinate analysis, and lag sequential analysis can offer meaningful and objective insights into what occurs in group psychotherapy from the angle of the therapist.

This study has three novel methodological aspects. First, it is the first to apply T-pattern detection to group psychotherapy with adolescents; second, it is first to combine T-pattern detection, polar coordinate analysis, and lag sequential analysis to analyze what occurs during the course of group psychotherapy from the perspective of the therapist; and finally, within the framework of a mixed methods study, our research incorporates one of the most powerful methods for linking qualitative and quantitative data, namely, the connecting method, which involves the systematized transformation of qualitative data into robust quantitative data for objective analysis.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Head of the Eulàlia Torras de Beà Foundation (FETB) Research Department. Approval by an ethics committee was not required as per applicable institutional and national guidelines and regulations. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

EA-P developed the project. MA conducted the method section and T-patterns, polar coordinate, and sequential analysis. Both authors participated in writing the article.

FUNDING

This study was supported by the Catalan Government under Grant number 2017 SGR 876 for the project Grup de Recerca de Parella i Família (GRPF). We also gratefully acknowledge the support of the Spanish Government subproject *Integration ways between qualitative and quantitative data, multiple case development, and synthesis review as main axis for an innovative future in physical activity and sports research* (PGC2018-098742-B-C31) (2019–2021) (Ministerio de Ciencia, Innovación y Universidades/Agencia Estatal de Investigación/European Regional Development Fund), part of the coordinated project *New approach of research in physical activity and sport from mixed methods perspective* (NARPAS_MM) (SPGC201800X098742CV0).

ACKNOWLEDGMENTS

We thank all those at the Center for Child and Adolescent Mental Health of Eulàlia Torras de Beà Foundation in Barcelona, Spain, who so willingly helped to make this study possible, as well as all the adolescents and families who participated. Finally, we also acknowledge support from Ramon Llull University (PGRiD of FPCEE Blanquerna).

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 12 August 2020
doi: 10.3389/fpsyg.2020.01667

A Phase Transition of the Unconscious: Automated Text Analysis of Dreams in Psychoanalytic Psychotherapy

Alessandro Gennaro[1], Sylvia Kipp[2], Kathrin Viol[3], Giulio de Felice[1,4], Silvia Andreassi[1], Wolfgang Aichhorn[3], Sergio Salvatore[1] and Günter Schiepek[3,5]*

[1] Department of Dynamic and Clinical Psychology, Sapienza University of Rome, Rome, Italy, [2] Institute of Health and Social Relations, FOM, University of Applied Sciences for Economics and Management, Essen, Germany, [3] Institute of Synergetics and Psychotherapy Research, University Hospital of Psychiatry, Psychotherapy and Psychosomatics, Paracelsus Medical University, Salzburg, Austria, [4] Faculty of Psychology, NCIUL University, London, United Kingdom, [5] Department of Psychology, Ludwig Maximilian University, Munich, Germany

OPEN ACCESS

Edited by:
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Christian Sell,
University of Kassel, Germany

***Correspondence:**
Sylvia Kipp
info@drkipp.de

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 17 March 2020
Accepted: 19 June 2020
Published: 12 August 2020

Citation:
Gennaro A, Kipp S, Viol K, de Felice G, Andreassi S, Aichhorn W, Salvatore S and Schiepek G (2020) A Phase Transition of the Unconscious: Automated Text Analysis of Dreams in Psychoanalytic Psychotherapy. Front. Psychol. 11:1667. doi: 10.3389/fpsyg.2020.01667

Aim: Psychotherapy could be interpreted as a self-organizing process which reveals discontinuous pattern transitions (so-called phase transitions). Whereas this was shown in the conscious process of awake patients by different measures and at different time scales, dreams came very seldom into the focus of investigation. The present work tests the hypothesis that, by dreaming, the patient gets progressively more access to affective-laden (i.e., emotionally charged) unconscious dimensions. Furthermore, the study investigates if, over the course of psychotherapy, a discontinuous phase transition occurs in the patient's capacity to get in contact with those unconscious dimensions.

Methods and Procedures: A series of 95 dream narratives reported during a psychoanalytic psychotherapy of a female patient (published as the "dreams of Amalie X") was used for analysis. An automated text analysis procedure based on multiple correspondence analysis was applied to the textual corpus of the dreams, highlighting a 10-factor structure. The factors, interpreted as affective-laden unconscious meaning dimensions, were adopted to define a 10-dimensional phase space, in which the ability of a dream to be associated with one or more local factors representing complex affective-laden meanings is measured by the Euclidean distance (ED) from the origin of this hyperspace. The obtained ED time series has been fitted by an autoregressive integrated moving average (ARIMA) model and by non linear methods like dynamic complexity, recurrence plot, and time frequency distribution. Change point analysis was applied to these non linear methods.

Results: The results show an increased frequency and intensity of dreams to get access to affective-laden meanings. Non linear methods identified a phase transition-like jump of the ED dynamics onto a higher complexity level of the dreaming process, suggesting a non linear process in the patient's capacity to get in contact with unconscious dimensions.

Conclusion: The study corroborates the hypothesis that, by dreaming, the patient gets progressively more access to affective-laden meaning intended as unconscious dimensions. The trajectory of this process has been reproduced by an ARIMA model, and beyond this, non linear methods of time series analysis allowed the identification of a phase transition in the unconscious process of the psychoanalytic therapy under investigation.

Keywords: text analysis, dream analysis, psychotherapy process, meaning, phase transition

INTRODUCTION

Process research is an essential source of knowledge on how psychotherapy works. Especially in psychoanalysis and in psychodynamic psychotherapies, single-case reports and case studies on change dynamics have a long tradition of more than one century, founded by Sigmund Freud. There is a great variety of case studies, from qualitative reports to sophisticated time series analysis studies. Reviews on the methodology of single-case research in psychodynamic psychotherapy were published by Hilliard (1993) and Fonagy and Moran (1993). Beyond the frame of psychoanalysis, the non linear dynamic systems approach promoted the field of case-related research designs by using non linear methods in order to understand chaotic dynamics and self-organized pattern transitions of cognitive, affective, and interpersonal processes (Kowalik et al., 1997; Schiepek et al., 1997, 2016a,b, 2018). Gumz et al. (2012) connected both fields by applying the method of dynamic complexity (DC) (Haken and Schiepek, 2010; Schiepek and Strunk, 2010) on the process ratings of patients and therapists in psychodynamic psychotherapies.

Usually, process research using high-frequency measures is based on transcripts, video tapes, socio-physiological measures, continuous self-reports, or electronic diaries. In most of the studies, the focus is on intra-session dynamics, with advanced developments in inter-session dynamics by using ecological momentary assessment or internet-based real-time monitoring (Schiepek et al., 2016a,b; 2018; Steffensen et al., in review). Most of the applied measures were taken from awake subjects during the therapeutic interaction or during moments of triggered self-reflection (e.g., writing diaries or doing quantitative self-assessments). Only few studies focused on dreams which were reported during the psychotherapeutic process.

One of the pioneering steps to relate changes of dream patterns to therapeutic change and personality development was done by Roesler (2018a,b). He used the qualitative method of structural dream analysis (SDA) in order to identify dream patterns and connected them to the psychological problems of the dreamers and to psychotherapeutic changes and to their personality development. SDA allows a systematic analysis of dream texts and contents during the therapeutic process. Older studies showed that the themes of dreams change during psychotherapy (Cartwright, 1977) and that dream themes correspond to the session protocols reflecting the current conflictual themes in the waking life of the dreamer (Greenberg and Perlman, 1978). Popp et al. (1990) compared the narratives of dreams and of therapy sessions using the method of Core Conflictual Relationship Themes (CCRT), showing that both narratives were structured by the same unconscious relationship patterns. Glucksman and Kramer (2004, 2006, 2012) highlighted a significant correlation between clinical improvement and thematic changes from the initial to the final dreams of the treatment. Qualitative therapeutic changes of recurrent post-traumatic nightmares were observed after focusing-oriented dream work (Ellis, 2016). Widmer (2019) applied the SDA method to a dream series which was documented by Kächele et al. (1999; Thomä and Kächele, 2006; "Amalie's Dreams," see "Methods") and found increased ego strength following five different dream patterns proposed by Roesler (2018a).

In summary, literature suggests that dreams are able to mirror clinical progress and personality development. Dreams prepare and pre-develop new ways of organizing life experiences and new ways of the patient's mental functioning. In accordance with Jung (1971), by dreaming, the unconscious brings new information to the conscious processing of a self-regulating system—the "psyche." By dreaming, the patients get access to increasingly deep affective-laden unconscious meanings on which the patient's relational and emotional life is grounded (see Venuleo et al., 2018). Following this pathway, changes and pattern transitions should occur in the contents and meanings of dream narratives during psychotherapy. The aim of the present study is to investigate the temporal evolution of the unconscious dimensions lying in the dreams of a single case of psychoanalysis.

Dreams and Change Processes

Dreams create or construct meaning in a way which is not restricted to the rules of conscious everyday thinking (secondary processes). The mental processes of dreaming are usually more affectively charged, and their functioning lies beyond the restrictions of time, space, causality, physical laws, and logic (primary processes). The unconscious is the mind's basic way of functioning, but it is also related to rational thinking. This relationship is framed by the concept of *affective semiosis* (Salvatore and Freda, 2011), which describes the functioning of minds by predominant primary processes but also by the activity of functions of differentiation (secondary processes). The affective and pre-semantic activity of interpreting experiences orients the processes of feeling and thinking. The affective semiosis frames and orients rather than executes regulative functions and provides the context as an implicit embodied presupposition which orients subsequent perceptive and cognitive activities. This relational context can be seen as the preferential trajectory of semiotic intersubjective activity of

producing and interpreting signs. The dynamic relational context promotes the flow of signs, and the flow of signs (re)produces the context. With reference to Matte Blanco's (1975) "bi-logic approach" and Ciompi's (1982) "affective logic," in the process of affective semiosis, thoughts emerge from emotions, and it shapes the flow of experiences into a contextual field conveying affective meanings.

Psychotherapy is an intersubjective process (Salvatore et al., 2010; Gennaro et al., 2011, 2017; Salvatore and Gennaro, 2012) which creates changes in self-concepts, schemata, or ways of problem solving (Nitti et al., 2010; Salvatore et al., 2010). In such process, as pointed out by Moser and von Zeppelin (1996), the organization of dreams may be considered as an entangled set of affective-cognitive procedures generating a micro-world—the dream—by which a person attempts to find a solution for an activated conflict. In this unconscious process of problem solving, information processing integrates cognitions and emotions (affective-laden thoughts). Accordingly, it may be expected that dreams produce contexts which allow us to get access to affective-laden meaning dimensions (i.e., unconscious) and to test new meanings as organizers of the patient's internal and external world.

The emergence of new meanings is a dialogical and contextual process which creates new narratives of dreams in the clinical setting. Specifically, as highlighted by the two-stage semiotic model (TSSM) (Salvatore et al., 2010), good outcome psychotherapies are characterized by alternating phases of consolidation and innovation of meanings (Gennaro et al., 2010, 2017; Salvatore et al., 2010; Rocco et al., 2018). This alternation is nourished by the recursive interplay between pre-semantic affective meanings underpinning the patient's sensemaking and their cognitive elaboration. Accordingly, the progress of psychotherapy is driven by allowing the patient to get access to increasingly deeper affective dimensions and shaping his life experiences and therefore facilitating the emergence of new meanings and their cognitive elaboration enriching a patient's ability to access increasingly deeper affective dimensions and their cognitive elaboration (Mergenthaler, 1996; Mergenthaler and Bucci, 1999; Bucci, 2011; Gennaro et al., 2011, 2017; Rocco et al., 2018).

In line with synergetics (Haken, 2004; Haken and Schiepek, 2010; Schiepek et al., 2016a), sensemaking could be described as a cognitive, affective, and intersubjective process in which emerging patterns (called "order parameters") enslave the mental states of both patient and therapist. In consequence, the narratives of the dreams, the experienced scenes of the dreams, and the interactive process of psychotherapy will be synchronized. Order parameters emerge from the interaction of many parts of a system and can be seen as constitutive patterns of the field dynamics. Emerging patterns result from phase transitions which represent qualitative changes of a system's modalities of working. Patterns of clinical change and transitions of cognitive-affective modes during psychotherapeutic processes have been analyzed and modeled in previous studies (e.g., Lauro-Grotto et al., 2009; Salvatore et al., 2009; Haken and Schiepek, 2010; de Felice and Andreassi, 2014; Schiepek et al., 2014, 2016a,b; Halfon et al., 2016; de Felice et al., 2019; Olthof et al., 2019; Schiepek et al., in press; Walter et al., 2010) and were simulated by a theoretical (mathematical) model of psychotherapeutic change (Schiepek et al., 2017; Schöller et al., 2018). Furthermore, the research based on the TSSM (for a review, see Gennaro et al., 2010; Nitti et al., 2010; Salvatore et al., 2010; Salvatore and Gennaro, 2015) highlights how specific patterns characterize the course of good outcome psychotherapies.

According to this framework, we hypothesize that through the course of a successful psychotherapy, the dream narratives increase the specificity of their affective charge as a marker of the patient's capacity to get access to increasingly deep affective-laden dimensions of sensemaking (HP1). Moreover, due to the field dynamics of sensemaking underpinning the clinical exchange, the increased affective charge of the dream narratives should follow a non linear trend (HP2).

Finally, we expect that the self-organizing process of the psychotherapy will show an increase in the complexity of dream dynamics within the phase space of the affective-laden meaning dimension (HP3). The dream dynamics should realize a discontinuous (non-stationary) evolution (phase transition), and a sudden change in complexity should be visible in different complexity measures.

MATERIALS AND METHODS

The Patient and the Dream Texts

Ninety-five dream narratives reported by a female patient during 517 psychoanalytic sessions (Kächele et al., 1999) were subjected to a procedure of text analysis (see below). Verbatim transcripts of the dreams were available from the "Inventory of Amalie's Dreams" at the University of Zürich (Meissner et al., 2009). Given that this is published material for scientific purposes, no ethics approval was needed. The full-text corpus of all 95 dreams had a length of 38,733 words with a range between 29 words for the shortest and 1,497 for the longest dream reports.

The female patient known under the pseudonym "Amalie X" was diagnosed with dysthymia (F34.1 in the ICD-10, which corresponds to chronic depression) and with disorder of sexual identity (F64). Since her adolescence, she has suffered from chronic hirsutism—an excessive hair growth on parts of the body where hair is normally absent or minimal. The hirsutism caused psychological distress and social difficulties, avoidance of social situations, and symptoms of anxiety and depression. On the other hand, distress intensified the abnormal hair growth, and this was the reason that she self-referred to psychotherapy in addition to endocrine therapy. The patient suffered from a reduced self-esteem and a distorted body image and challenged her sexual identity as a woman. In consequence, she avoided any closer, especially sexual, contacts with men. The details of the psychoanalytic therapy which was realized by a session frequency of about three times per week are reported in Kächele et al. (1999). Different outcome and process measures [e.g., self-esteem (Neudert et al., 1987) or psychological strain (Neudert and Hohage, 1988)] considered the case as good outcome (see also Thomä and Kächele, 2006).

Dreams Text Analysis

We performed, by means of T-Lab software (Lancia, 2002, 2005), an automated procedure of text analysis over the transcripts of Amalie's dreams. This analysis is an Automated Co-occurrence Analysis for Semantic Mapping (ACASM) adjusted for the specific dataset (for specific details of the method and its rationale, see Gennaro et al., 2010; Salvatore et al., 2012, 2017a,b). ACASM was developed in order to identify thematic contents in texts by a cluster analysis procedure applied to words which are associated with each other. The procedure of text analysis we used in this study overlaps the ACASM procedure in the algorithms of text segmentation and in the identification and selection of the lexical forms under analysis. Unlike the ACASM procedure, which performs a cluster analysis procedure to get a semantic description of a text, the present works adopted a correspondence analysis (see below).

The text analysis procedure was performed according to the following steps. Firstly, the textual corpus of dream narratives was split into units of analysis, called elementary context units (ECUs). Each ECU corresponds to a dream narrative. Secondly, the lexical forms present in the ECUs have been identified and categorized according to the "lemma" they belong to. A lemma is the citation form (namely, the headword) used in a language dictionary: for example, word forms such as "go," "goes," "going," and "went" have "go" as their lemma; "child" and "children" have "child" as their lemma. Thirdly, lemmas were ranked according to their frequency. The 5% highest-frequency lemmas were omitted by the fact that the higher the frequency of a lemma, the less it contributes to the discrimination among the ECUs. High-frequency lemmas (e.g., words like "and," "to," and "of") are not specific to any ECU. Then the lemmas were ranked according to their frequency, and the 10% most frequent lemmas were selected in order to obtain a digital matrix of the corpus, having as rows the ECU (i.e., the dream narratives), as columns the lemmas, and in the cell x_{ij} the value "1" if the *j*th lemma was contained in the *i*th ECU; otherwise, the x_{ij} cell received the value "0." A correspondence analysis on the obtained matrix allowed retrieval of the factors describing lemmas having higher degrees of association, i.e., occurring together many times. According to Salvatore et al. (2015, 2017a,b), each factor was interpreted as an affective-laden meaning characterized by strongly associated (co-occurring) lemmas (see the **Appendix** of this article).

Based on the factors, a multidimensional phase space was created in which each dream is represented in terms of a vector whose components are described in terms of the squared cosine, representing the correlation between a dream and a factor. The higher the squared cosine of a dream for a specific factor, the higher the fitting of a dream with the respective affective meaning (factor).

Affective Charge Analysis

For each dream vector, the Euclidean distance (ED) from the origin of the factor space has been computed. The higher the ED value, the greater the *local* incidence of one or more factors representing a dream in the phase space. The ED has been interpreted as the degree to which a certain dream is able to reach affective-laden meanings described by the factors. The higher the ED value, the greater the incidence of one or more factors determining the meaning of a dream. The incidence of polarized values on factors has been considered as a marker of the affective characteristics of the meaning (Salvatore and Freda, 2011; Salvatore et al., 2017a,b). The arithmetic average of all ED vectors was calculated in order to define a *centroid* around the origin of the phase space. By this, each dream vector was categorized as lying inside or outside of the centroid. Dreams categorized as lying outside of the centroid, that is, having an ED in the multidimensional factor phase space greater than the average of the EDs of all dreams, could be addressed as highly associated with one or more factors; in other words, they address the affective-laden meanings displayed by the factors.

Time Series Analysis

In order to test the hypothesis of an increased frequency of getting access to affective-laden meanings during psychotherapy (HP1), a logistic binary regression model was calculated with "time" (the sequence of dreams from 1 to 95) as the independent variable and the categorization of dreams as lying inside or outside of the centroid as the dependent variable.

In order to test the extent by which affective-laden meanings are reached (HP2), a non linear model of the process has been tested. Specifically, we adopted an autoregressive integrated moving average [$ARIMA_{(p,d,q)}$] model[1]. $ARIMA_{(p,d,q)}$ is a data-based modeling procedure which derives stepwise predictions and formalizes the variation of a time series as a function of one or more predictors (e.g., the time series itself) and stochastic noise (McCleary and Hay, 1980; Hyndman and Athanasopoulos, 2014; Jebb et al., 2015). In $ARIMA_{(p,d,q)}$ models, p is the autoregressive component representing a linear regressive dependency of a time series value on its preceding p values, d indicates the order of differencing that has been applied to the time series in order to remove any trend from the data, and q represents a linear regression of a current value of the time series against prior random errors (McCleary and Hay, 1980; Jebb et al., 2015). In our case, we adopted an $ARIMA_{(1,1,1)}$ model (see section "Results") with "time" (the sequence of dreams from 1 to 95) as an independent variable and the EDs as a dependent variable.

DC Analysis

According to the third hypothesis, the EDs of each dream were subjected to three procedures of complexity analysis: DC, recurrence plot (RP), and time frequency distribution (TFD).

[1]ARIMA, which stands for autoregressive integrated moving average, is a model for time series data that incorporates both autoregressive and moving average features, along with detrending of the data. The AR part—p parameter—means that the values are regressed on their own lagged values; the MA part—q parameter—means that the regression error is a linear combination of past error terms; thus, it requires a non linear estimation algorithm to be used. Finally, the I part—d parameter—means that the data have been differenced to remove trend. If on one hand, ARIMA models could be assumed as a linear model (in that the parameters are linear), strictly speaking, they could not be thought of that way: linear models generally involve a dependent variable that is regressed on a number of independent variables, rather than the same variable at previous time points. In our case, the presence of the MA component let us consider the ARIMA as a non linear model.

DC (Haken and Schiepek, 2010; Schiepek and Strunk, 2010) is the multiplicative product of a fluctuation measure and a distribution measure applied to discrete time series (in this case, the ED sequence of all dreams) with a given data range $[x_{min}, x_{max}]$. The fluctuation is sensitive to the amplitudes and frequencies of a time signal, and the distribution scans the scattering of values over the range of possible values. In order to identify non-stationarity, DC is calculated within a moving window running over the time series (window width: 7, overlap: step 1). The window width was chosen as seven because this corresponds to other applications of the DC method on psychotherapy processes and because with this small width, we do not lose too many time points. On the other hand, seven measurement points is sufficient to calculate the DC.

RPs identify recurrent patterns of time series in a time × time diagram (Eckmann et al., 1987; Webber and Zbilut, 1994). Snippets of a full time series are embedded in a phase space with time-delay coordinates. The number of time-delay embedding coordinates corresponds to the snippet length (here: 3), and the time delay τ between the embedded measurement points is defined by the first zero-crossing or the first minimum of the autocorrelation of the time series (here: $\tau = 1$). By this method, each snippet of the time series is embedded in the time-delay phase space by a vector point. The cell entries in the time × time RP are the EDs between the vector points (distance matrix) which are rainbow color-coded with blue (smallest distance) = recurrent to red (longest distance) = transient. In an RP, recurrent patterns and their transients become apparent.

TFD is a method to calculate and visualize the frequency of a signal (time series) as it changes with time (Cohen, 1989; Sejdić et al., 2009). In order to identify frequency changes, a moving window approach is implemented. Mathematically, both time t and frequency ω are variables of a distribution $P(t, \omega)$ which describes the amplitude of the signal at each given t and ω. Here, we use the so-called Stockwell transform (*S*-transform), which is a combination of two common TFD methods, the short time Fourier transform and the continuous wavelet transform (Stockwell et al., 1996). It preserves the phase information available from the former method but uses the variable (i.e., not fixed) window length of the continuous wavelet method. For visualization, time and frequency are plotted on a plane (x: time, y: frequency), and color coding is used for the representation of the amplitudes of the frequencies.

In a last step of testing the non linear phase transition hypothesis, the ED time series, the DC time series, the RP, and the TFD of the ED time series were subjected to a change point analysis (CPA, Killick et al., 2012) in order to identify the time point where a phase transition occurs. CPA is sensitive to changes of specific statistical properties of a time series x. It contains a change point if it can be split into two segments x_1 and x_2 such that $C(x_1) + C(x_2) < C(x)$, where C represents the cost function, $C(x) = N\text{var}(x)$, and N is the number of time points of x. In other words, a change point is detected between the segments x_1 and x_2 if the sum of the variance of the statistical property of interest, e.g., the mean of the segments, is smaller than the variance of this property of the whole time series; otherwise, no change point is detected. In our application, we used CPA for the detection of changing variance in the ED time series. The analysis was done with the function *ischange* implemented in Matlab.

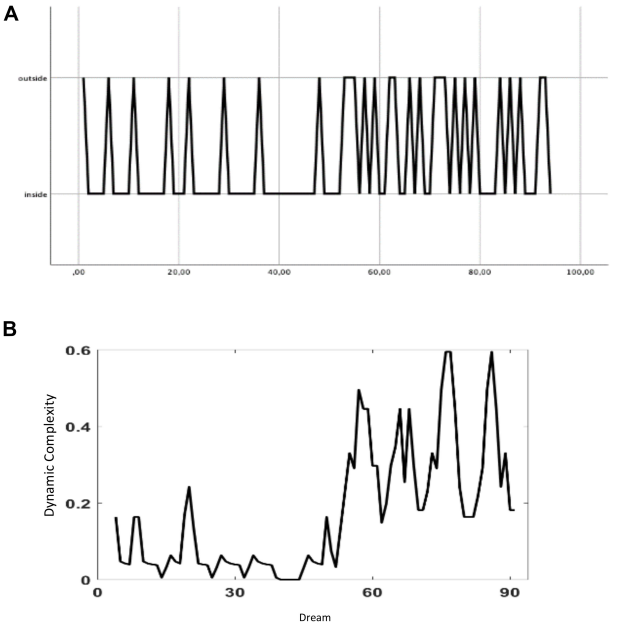

FIGURE 1 | (A) Binary coded time series of dreams within the centroid (value 1) or outside the centroid (value 2) of the 10-dimensional factor space. **(B)** Dynamic complexity of the binary coded time series **(A)** (window width: 7).

RESULTS

Preliminary Dream Text Analysis

The procedure of multiple correspondence analysis (MCA) applied to the dreams × lemmas matrix identified 10 factors which explained 27.84% of the variance of the matrix. In light of the high dispersion of the data in the matrix under analysis, this represents a high percentage of explained variance (see Benzecri, 1973, 1979; Bolasco, 1999), especially with respect to the fact that the rate of variance depends on the number of variables under analysis—280 lemmas in our case.

Hypothesis 1

As highlighted in the section "Materials and Methods," the affective charge of dream narratives was calculated in terms of

TABLE 1 | Logistic regression model with "time" as a predictor of the probability of dreams to overcome the centroid threshold.

	β	SE	Wald	*p*	OR
Time	0.190	0.009	4.758	0.029	1.019
Constant	−1.829	0.524	12.195	0.000	0.161

β, regression weight of "time"; SE, standard error; Wald, test the significance of the relation between the independent variable and the criterion in the logistic model; p, probability of the Wald test; OR, odds ratio.

ED. The ED from the origin of the phase space and each dream vector was computed, and according to the overall mean of the EDs (arithmetic average = 0.536), the centroid was defined. Sixty-six dreams (70.2%) were proven to lie within the centroid and 28 dreams (29.8%) outside of it. **Figure 1A** shows their distribution according to the calculated centroid over the course of the psychotherapy. As can be seen, the frequency of highly affective-charged dreams (i.e., lying outside of the centroid) increases in the second part of the therapy. The DC of this binary oscillation is spontaneously increased after about the 58th dream (**Figure 1B**).

In order to estimate the probability that the frequency of affective-charged dream narratives (high vs low affective charge according to the calculated centroid) increases a function of time, a binary logistic regression has been performed. The logistic binary regression model identified the significant role of "time" (the sequence of dreams from 1 to 95) as a predictor for the probability of dreams to exceed the centroid threshold, that is, to be more associated to affective-laden meanings (**Table 1**). The predictor "time" was statistically significant (χ^2 = 5.07, df = 1, p = 0.024). The concordant association of predicted probabilities and observed responses was 70.20%. Based on the odds ratio (ORs = 1.019), the logistic binary regression model reveals that the number of highly affective charged dream narratives increases during the course of the psychotherapy process.

Hypothesis 2

HP2 was tested by means of an ARIMA model having the extent of the EDs as the dependent variable and time as the independent variable. On the basis of a preliminary estimation of the autocorrelation function (ACF) and the partial ACF (PACF) applied to the ED time series (**Figure 2**), the following parameters were set in the ARIMA$_{(p,d,q)}$ model: p = 1, d = 1, and q = 1.

The ARIMA$_{(1,1,1)}$ model fitted to the data (**Figure 3**) and explained a variance (R^2) of.594, the Ljung–Box test (Q = 23.15; df = 16; p = 0.110) testing the white noise of residuals showed that the null hypothesis that all correlations are equal to zero cannot be rejected (where $p > 0.05$; thus, residuals represent white noise).

The parameters of the ARIMA$_{(1,1,1)}$ model AR1 and MA1 were statistically significant ($p < 0.05$ and $p < 0.001$, respectively; see **Table 2**). The ACF and PACF graphs (**Figure 4**) of the residuals of the ARIMA$_{(1,1,1)}$ model confirmed that the data were fully modeled and that "time" predicts the extent of ED.

Hypothesis 3

With reference to the ED time series of all dreams (**Figure 3**, black line), DC, recurrence, and frequency measures were applied (**Figure 5**). DC, RP, and TFD show a changed pattern after about two thirds of the dream sequence, with increased DC (**Figure 5C**), increased complexity in the sense of more transient and less recurrent patterns in the RP (**Figure 5D**), and increased frequency amplitudes (**Figure 5E**). In the TFD diagram, the emergence of the red amplitudes indicates the highest amplitudes of the frequency distribution. CPA was

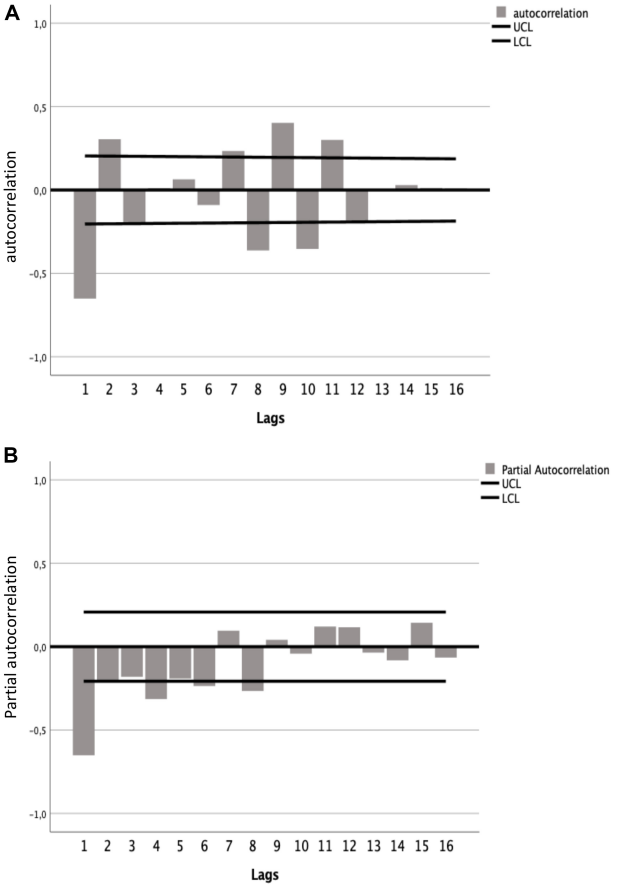

FIGURE 2 | (A) Autocorrelation function (ACF) and **(B)** partial autocorrelation function (PACF) graphs. The straight lines above and below the 0.0 line indicate the 95% confidence interval (CI). ACF and PACF values (black bars) which clearly exceed the CI line appear only at lag 1, suggesting an AR1 (p = 1) and MA1 (q = 1) model.

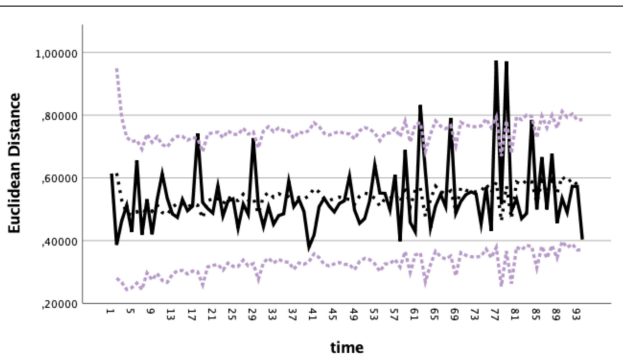

FIGURE 3 | Time series of the Euclidean distances (EDs) of each dream from the origin in the factor phase space (black line) and the curve of the fitted ARIMA$_{(1,1,1)}$ model (black dotted line) within a confidence band (dotted gray lines: upper and lower limits of the 99% confidence interval).

TABLE 2 | The parameters of the $ARIMA_{(1,1,1)}$ model.

	Value	SE	*t*	*p*
Constant	0.011	0.000	2.578	0.012
AR lag 1	−0.240	0.106	−2.272	0.025
Difference	1	–	–	–
MA lag 1	0.995	0.176	5.654	0.000

SE, standard error; t, t value; p, probability of the t value.

applied to the ED time series and to the DC, the RP, and the TFD of the ED time series. The change points (criterion: changing variance) indicated a transition at dream 57 in the ED time series (**Figure 5B**), at dream 60 in the DC of the ED time series (**Figure 5C**), at dream 59 in the RP of ED time series (**Figure 5D**), and at dream 57 in the TFD of the ED time series (**Figure 5E**). The average of these change points demarcates a pattern transition at dream 58 (straight line in **Figure 5A**).

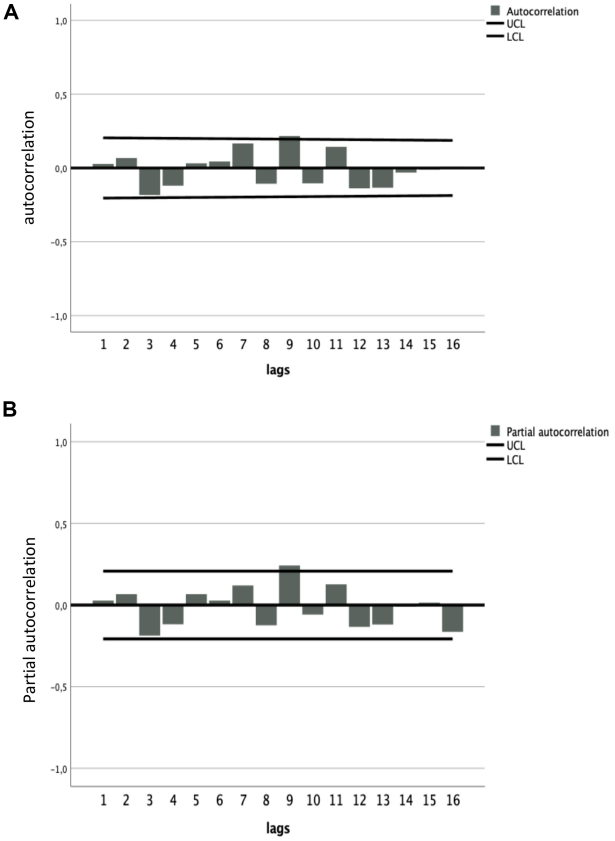

FIGURE 4 | (A) Autocorrelation function (ACF) and **(B)** partial autocorrelation function (PACF) of the residuals of the $ARIMA_{(1,1,1)}$ model. The straight lines above and below the 0.0 line indicate the 95% confidence interval (CI). The correlation values (gray bars) lie within the 95% CI limits, which indicates that the errors of the residuals are white noise. This proves that the model is appropriate for prediction.

DISCUSSION

The sequence of 95 dream narratives which were reported during a psychoanalytic therapy of more than 500 sessions realized over a period of more than 4 years—the famous case of "Amalie X"—revealed interesting results. The present work assumes dreams as a context which sustains the re-elaboration of relational meanings regulating the patient's internal and external worlds. According to this framework, the ACASM was applied to the dreams × lemmas matrix obtaining a 10-dimensional factor space. Each factor represents an unconscious dimension which is based on strongly associated (co-occurring) words in the dream narratives.

According to our first hypothesis, the results highlighted an increased access to affective-laden meanings during the course of the psychotherapy. Concerning the second hypothesis, the results showed that the affective polarization of the dream narratives has been proven to increase following a non linear trend.

Taken together, the results shed light on the nature of the psychoanalysis as an intersubjective process aimed to sustain the patient toward a higher ability to get in touch with affective-laden meanings (i.e., unconscious dimensions) regulating and organizing life experience.

The dream narratives increase their frequency (HP1) in reaching highly affective-laden meanings, and the affective charges of the dream narratives increase in intensity among time (HP2). Taken together, HP1 and HP2 support the view of the clinical process as a recursive dynamics enriching the patient's ability to explore—increasingly deep—unconscious dimensions (i.e., affective-laden meanings) in order to promote their cognitive–affective elaboration.

The third hypothesis is corroborated by showing a sudden jump of complexity offering a deeper understanding of the clinical process in terms of a non linear phase transition. Taken together, the converging evidence of DC, RP, and TFD of the ED dynamics, around dream number 58, a sudden change in the variability and complexity of the clinical process has been highlighted. The method of CPA following the criterion of changing variance was used to identify the transition in the measures and in the ED time series itself.

Hypothesis 3 enriches the view of hypotheses 1 and 2 on the clinical process: synergetics states that during psychotherapeutic processes, order parameters emerge which enslave the mental states of the patient and therapist. In consequence, the narratives of the dreams, the experienced scenes of the dreams, and the self-related and interactive process of psychotherapy get synchronized.

The phase transition highlighted in the 58th dream narrative—corresponding to the 328th psychoanalytic session—has been highlighted as a clinical turning point by several authors: the chronically depressed female patient who always avoided any close relationship, especially sexual contacts with men, and suffered from a reduced self-esteem and a distorted body image actively started to get in contact

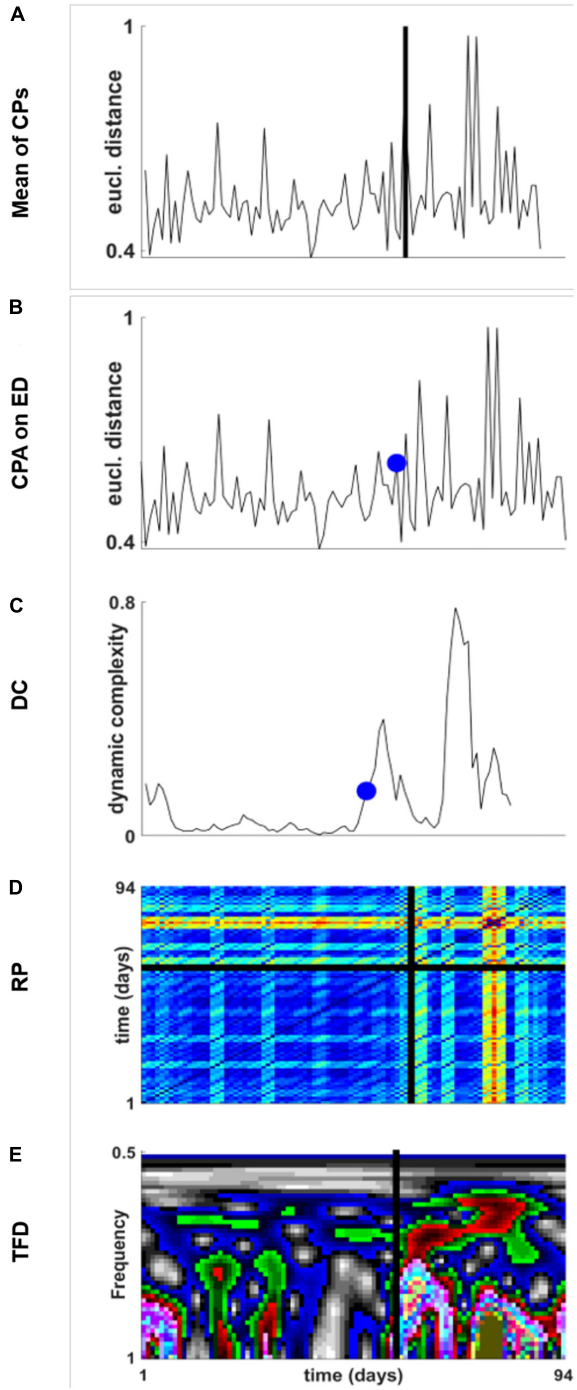

FIGURE 5 | (A) Time series of the Euclidean distances of each dream (compare with the black curve in **Figure 3**). The straight vertical line indicates the average of the change points identified on the ED time series by CPA. Criterion of the CPA: changing variance. **(B)** CPA (blue dot) applied to the ED time series. **(C)** CPA (blue dot) applied to the DC (window width: 7) of the ED time series. **(D)** CPA (black vertical line) applied to the RP of the ED time series. Parameters: Three embedding dimensions and $\tau = 1$. CPA was applied to each line and column of the RP. **(E)** CPA (black vertical line) applied to the TFD of the ED time series. The red colors indicate the highest amplitudes of the time-dependent frequency distribution. The average of the change points is at dream 58 [black line in panel **(A)**].

with men and had her first erotic and sexual experiences. Additionally, the patient emancipated from her mother with whom she experienced a very close, dependent, and symbiotic relationship. At the time of the phase transition, Thomä and Kächele (2006, p. 283, Figure 6.1) also reported on a discontinuous reduction of her verbal activity during the sessions. With reference to the five types of dream patterns identified by Roesler (2018a, 2020), Widmer (2019) visualized a frequency transition reflecting an increased ego strength of the patient and an intensified "authorship" of the dream ego.

The open question is if the phase transition after dream number 58 is relevant for the personality development of the patient. How is the relationship between the content(s) of the dreams, the ongoing psychotherapy, the development of the personality, the symbols and the themes, and the inner process (i.e., the core conflictual themes) related to the phase transition? Is it possible to find this phase transition also in the transcripts of the sessions? These questions will be investigated in the next step of the analysis of Amelie's dream reports according to the transcripts of the therapeutic sessions.

CONCLUSION

Taken together, the present results sustain the empirical effort of investigating the process of psychoanalysis by looking at the evolution of dreams. Nevertheless, some limitations that could direct future research efforts should be mentioned.

The study focuses exclusively on dreams without taking other reports or measures of the psychoanalytic process into account. In a next step, the transcripts of the therapeutic conversation should be analyzed in parallel to the dreams. For this case of "Amelie X," the transcripts of 517 sessions are available. Secondly, in order to get a deeper understanding of therapeutic change processes, further data sources and parameters (e.g., self-assessments by electronic real-time monitoring devices, coding of session-by-session video tapes, and physiological measures during or in between sessions) should be used for a multilevel analysis of much more than one patient. Thirdly, the synergetic approach which was adopted here has a *post hoc* nature without any predictive value. Nevertheless, it is interesting to notice that the detected change point at about dream 58 corresponds to a clinical shift detected by previous clinical work.

Future research should take these limitations into consideration in order to relate qualitative changes of the dream dynamics to the therapeutic conversation and to the patient's everyday life (see Thomä and Kächele, 2006). Albeit dreams are acknowledged as the "royal road" to the unconscious (Freud, 1900), the investigation of unconscious processes should be supplemented by the investigation of conscious processes, physiology, and behavior. Reaching such aim requires an interdisciplinary research paradigm able to describe the clinical process in terms of the interaction between the client's lifestyle scenario, the therapeutic system, and the context of

therapy (Schiepek et al., 1992). The present work underlines the importance of moving from the traditional outcome research toward a research on the process (Salvatore et al., 2009), including the measurement of the non linearly interrelated factors which are responsible for conveying change in a clinical case (Tschacher and Ramseyer, 2009; Haken and Schiepek, 2010; Schiepek et al., 2014, 2017; Schöller et al., 2018). The results and the adopted methodological framework are part of a general paradigm describing the clinical change dynamics in terms of self-organization and non linear systems theory.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX

In the following, we present an example to highlight the factors retrieved by MCA, their interpretation, their EDs, and their categorization as lying inside or outside the centroid. In this illustrative example, the analysis reveals two factors, and the factor interpretation is based on 20 lemmas characterizing the factors. This result is able to restore the conceptual and clinical value of the adopted measures.

Table A1 offers an example concerning the characterization of two factors according to 20 retrieved lemmas detected by the MCA procedure. Based on the squared cosine which represents the degree of association of each word to the retrieved factors, the factors have been interpreted as "family images" (factor 1) and "social actions" (factor 2). We remind that here we are reporting just an example of the performed analysis in order to shed light on its rationale; as a matter of fact, the paper is focused on formal and quantitative aspects aimed to present technical and formal solutions of analysis able to track dream evolution among the clinical process; thus, it does not take into consideration the qualitative aspects—i.e., the meaning of retrieved factors. Further studies will investigate the contents of factors, dreams, and their clinical evolution.

TABLE A1 | Description of factor 1 and factor 2 concerning the first 20 lemmas retrieved by dream narrative analysis.

Factor 1		Factor 2	
Lemma	**Squared cosine**	**Lemma**	**Squared cosine**
to see	0.742	root	0.969
uncle	0.681	tree	0.968
to find	0.571	to fall	0.594
Home	0.351	to want	0.593
to think	0.251	long	0.593
Father	0.229	figure	0.560
Image	0.135	relationship	0.481
remember	0.066	down	0.468
Dream	0.063	garden	0.420
to fall	0.048	to define	0.400
to bring out	0.043	speak	0.353
atmosphere	0.038	things	0.342
shoe	0.037	wait	0.331
dining room	0.033	ground	0.312
family	0.031	to wake up	0.188

In **Table A2**, we report the squared cosine of 10 selected dreams out of 95 concerning factor 1 and factor 2 together with the calculated ED from the origin of the phase space defined by factor 1 and factor 2, respectively. The ED from the origin of the factorial space was calculated for each dream as $\sqrt{(\text{squared cosine factor1})^2 - (\text{squared cosine factor2})^2}$. The centroid, calculated as the arithmetic mean of the EDs of the 95 dream narratives according to factor 1 and factor 2, was 0.67.

TABLE A2 | Squared cosine of each dream for the retrieved factors and calculated ED.

Dream	Squared cosine in factor 1	Squared cosine in factor 2	ED	Position to the centroid
10	0.021	0.113	0.114	Outside
21	0.074	0.034	0.082	Outside
26	0.037	0.030	0.047	Inside
42	0.004	0.083	0.083	Outside
53	0.009	0.064	0.065	Inside
60	0.000	0.047	0.047	Inside
64	0.022	0.117	0.119	Outside
82	0.039	0.001	0.039	Inside
86	0.004	0.096	0.096	Outside
92	0.035	0.010	0.036	Inside

In **Figure A1**, we represent graphically the factorial space defined by factor 1 and factor 2 and the calculated centroid. The higher the ED value for each dream, the greater the incidence of one or more factors in determining the affective-laden meaning of a dream.

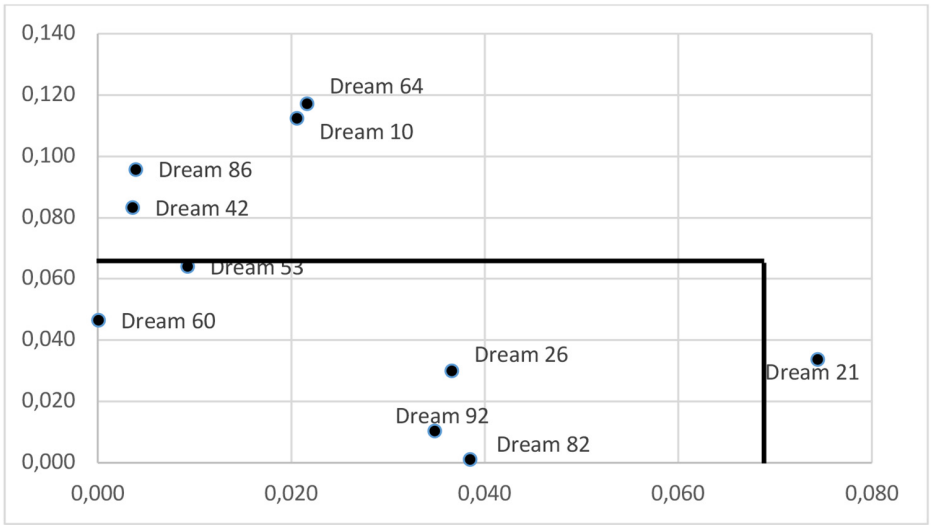

FIGURE A1 | Representation of a sample of dreams related to the mean of the EDs (centroid). The *x*- and *y*-axis represent factor 1 and factor 2, respectively. The black line represents the centroid.

frontiers in Psychology

ORIGINAL RESEARCH
published: 26 August 2020
doi: 10.3389/fpsyg.2020.01970

Convergent Validation of Methods for the Identification of Psychotherapeutic Phase Transitions in Time Series of Empirical and Model Systems

Günter Schiepek[1,2], Helmut Schöller[1], Giulio de Felice[3,4], Sune Vork Steffensen[5,6], Marie Skaalum Bloch[7], Clemens Fartacek[1], Wolfgang Aichhorn[1] and Kathrin Viol[1]*

[1] Institute of Synergetics and Psychotherapy Research, University Hospital of Psychiatry, Psychotherapy and Psychosomatics, Paracelsus Medical University, Salzburg, Austria, [2] Department of Psychology, Ludwig Maximilian University of Munich, Munich, Germany, [3] Department of Dynamic and Clinical Psychology, Sapienza University of Rome, Rome, Italy, [4] Faculty of Psychology, NCIUL University, London, United Kingdom, [5] Centre for Human Interactivity, Department of Language and Communication, University of Southern Denmark, Odense, Denmark, [6] Center for Ecolinguistics, South China Agricultural University, Guangzhou, China, [7] Outpatient Clinic of Anxiety Disorders and Personality Disorders, Brønderslev Psychiatric Hospital, Brønderslev, Denmark

OPEN ACCESS

Edited by:
Gian Mauro Manzoni, eCampus University, Italy

Reviewed by:
Eleonora Volpato, Fondazione Don Carlo Gnocchi Onlus (IRCCS), Italy
Hans Menning, University of Zurich, Switzerland

***Correspondence:**
Günter Schiepek
guenter.schiepek@ccsys.de

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *21 January 2020*
Accepted: *16 July 2020*
Published: *26 August 2020*

Citation:
Schiepek G, Schöller H, de Felice G, Steffensen SV, Bloch MS, Fartacek C, Aichhorn W and Viol K (2020) Convergent Validation of Methods for the Identification of Psychotherapeutic Phase Transitions in Time Series of Empirical and Model Systems. Front. Psychol. 11:1970. doi: 10.3389/fpsyg.2020.01970

Aim: In many cases, the dynamics of psychotherapeutic change processes is characterized by sudden and critical transitions. In theoretical terms, these transitions may be "phase transitions" of self-organizing nonlinear systems. Meanwhile, a variety of methods is available to identify phase transitions even in short time series. However, it is still an open question if different methods for timeseries analysis reveal convergent results indicating the moments of critical transitions and related precursors.

Methods and Procedures: Seven concepts which are commonly used in nonlinear time series analysis were investigated in terms of their ability to identify changes in psychological time series: Recurrence Plots, Change Point Analysis, Dynamic Complexity, Permutation Entropy, Time Frequency Distributions, Instantaneous Frequency, and Synchronization Pattern Analysis, i.e., the dynamic inter-correlation of the system's variables. Phase transitions were simulated by shifting control parameters in the Hénon map dynamics, in a simulation model of psychotherapy processes (one by an external shift of the control parameter and one created by a simulated control parameter shift), and three sets of empirical time series generated by daily self-ratings of patients during the treatment.

Results: The applied methods showed converging results indicating the moments of dynamic transitions within an acceptable tolerance. The convergence of change points was confirmed statistically by a comparison to random surrogates. In the three simulated dynamics with known phase transitions, these could be identified, and in the empirical cases, the methods converged indicating one and the same transition (possibly the phase transitions of the cases). Moreover, changes that did not manifest in a shift of mean or variance could be detected.

Conclusion: Changes can occur in many different ways in the psychotherapeutic process. For instance, there can be very slow and small transitions or very high and sudden ones. The results show the validity and stability of different measures indicating pattern transitions and/or early warning signals of those transitions. This has profound implications for real-time monitoring in psychotherapy, especially in cases where a transition is not obvious to the eye. Reliably identifying points of change is mandatory also for research on precursors, which in turn can help improving treatment.

Keywords: self-organization, phase transitions, pattern identification, nonlinear methods, change points, real-time monitoring, phase-transition detection algorithm, PTDA

INTRODUCTION

During the last decades, theories and methods of nonlinear dynamic systems got in the focus of psychotherapy and counseling research. One important quality of nonlinear dynamic systems is their ability to spontaneously create patterns which are not imposed from the outside, but emerge from the interactions of subsystems or parts of a system. The spontaneous emergence of ordered states out of disorder or the transition from one ordered state to another is called *self-organization* (Strunk and Schiepek, 2006; Gelo and Salvatore, 2016). Currently, the most prominent theory and methodology to understand, model, and analyze self-organizing processes is Synergetics (Haken, 2004; Haken and Schiepek, 2010). Phenomenologically, the emergence or transition of patterns takes place in discontinuous jumps, corresponding to "sudden gains" or "sudden losses" in psychotherapy (Stiles et al., 2003; Kelly et al., 2005; Busch et al., 2006; Hayes et al., 2007; Heinzel et al., 2014; Olthof et al., 2019b; de Felice et al., 2019, 2020). Synergetics provides the mathematical framework for modeling and explaining these discontinuous processes (*phase transitions*). In a strict sense, phase transitions occur by shifting one or more control parameter(s) which change the energy dissipation or other conditions of system functioning, e.g., the nonlinear interactions between components or subsystems. Usually, critical instabilities precede transitions, which can be transitions from disorder to order (emergence of one or few order parameters) or from one ordered state to another. In contrast to mathematical modeling (Haken, 2004; modeling of movement transitions: Haken et al., 1985; modeling of psychotherapeutic change dynamics: Schiepek et al., 2017; Schöller et al., 2018) or to physical experiments (e.g., LASER, fluid dynamics, Haken, 2004) in psychological or social real-world systems we often do not know the control parameters and/or cannot manipulate them. Mental processes or emotional functioning are not directly accessible to parameters which can be arbitrarily controlled by an experimenter, a trainer, or a therapist (Schöller et al., 2018). Additionally, control parameters and boundary conditions often are not stable but for their part evolving and unstable, with the consequence that dynamic patterns (attractors) are changing and after a transient period are moving into new patterns. This is what Haken (2004) calls "quasi-attractors." Given these restrictions of the concept of "phase transitions," we call changing patterns which do not fulfill all definitory criteria of the concept by the weaker term of "order transitions" (Haken and Schiepek, 2010).

It should be noted that pattern transitions – fulfilling the strict criteria of phase transitions or not – are not only characterized by changes of the mean level of the respective signals, what in psychotherapy research is known as "sudden gains" or "sudden losses," but by changes of a great variety of dynamic features. This could be transitions from a point attractor to a more or less complex rhythm, from some kind of periodicity to another kind of periodicity characterized by different amplitudes and/or frequencies, from a periodic regime to chaos, or from one type of chaos (e.g., low-dimensional) to another type (e.g., high-dimensional), with transitions in both directions. A systematic classification of transitions is still missing and should be developed in psychotherapy research and other fields of psychology.

In time series characterizing human change processes by psychological measures (e.g., self-ratings), the transition points can be identified by a diversity of methods. Here we focus on methods which can be applied to short time series (100 measurement points or less) and are able to identify pattern transitions and/or precursors of those transitions. Further criteria for the selection of methods is that they should not be restricted by mathematical or parametric assumptions, applicable to real-world time series, and available in computer-based tools for routine process monitoring (e.g., the Synergetic Navigation System, SNS; Schiepek et al., 2018).

The aim of this article is to get an estimate of the validity and stability of different measures indicating pattern transitions and/or early warning signals of those transitions in nonlinear and non-stationary systems. Robust and quantifiable measures of transitions and their precursors are important for science and practice. For science, because research questions focus on the bio-psycho-social multi-level dynamics of phase transitions and the related mechanisms of change (Schiepek et al., 2013) and for practice, because clinical decisions need valid indicators of precursors and early warning signals preceding transitions to the better, e.g., for triggering steps of change, or to the worse, e.g., for preventing suicidal crises. Convergent indicators should help to avoid false positives as well as false negatives in the identification of transitions.

MATERIALS AND METHODS

Methods of Time Series Analysis for the Identification of Transitions

In the following we apply different linear and nonlinear methods of time series analysis to model systems (computer simulations based on mathematical models) and to empirical systems (psychotherapeutic processes assessed by daily self-ratings) undergoing a significant transition.

Recurrence Plots (RP)

This method identifies recurrent patterns of time series in a time × time diagram (Eckmann et al., 1987; Webber and Zbilut, 1994). A recurrence plot is a square matrix that visualizes times at which a pattern of a dynamical system is identical or very similar to a pattern that has occurred before. In time series of one variable, as in our examples, the pattern of the system is identical to several consecutive values of the variable. For example, one pattern could be "linear increase," another one "increase and decline." The color of each element of the matrix indicates the similarity between the patterns at each time: in the recurrence plots of **Figures 1**, **2** blue indicates similar (recurrent) patterns, red very different patterns. The color of the matrix thus indicates times where the pattern of the time series changes.

Technically, snippets of a full time series are embedded in a phase space with time-delay coordinates. This implicates that the number of time-delay embedding coordinates, corresponding to the snippet length, and the time delay τ between the embedded measurement points have to be defined. Usually, τ is defined by the first zero-crossing or the first minimum of the autocorrelation or of the transinformation function of the time series. By this method, each snippet of the time series is embedded in the time-delay phase space by a vector point. The cell entries in the time × time Recurrence Plot can be the Euclidean distances between the vector points (distance matrix) which are rainbow color-coded with blue = recurrent to red = transient, or, the distances can be binary coded according to a selected threshold. Technically, this threshold corresponds to the radius of a hypersphere[1] which defines which other vector points are "neighbors," that is, similar or "recurrent" segments of the dynamics. In a Recurrence Plot, recurrent patterns and their transients become apparent. For all Recurrence Plots we defined 3 time-delay embedding coordinates for each time series with $\tau = 1$.

Change Point Analysis (CPA)

The method (Killick et al., 2012) is sensitive to changes of specific statistical properties of a time series. A time series x contains a change point if it can be split into two segments x_1 and x_2 such that $C(x_1) + C(x_2) + k < C(x)$, where C represents the cost function, here $C(x) = Nvar(x)$, k is a threshold, and N the number of time points of x. In mathematical optimization, a cost function determines how well the data fit a certain assumption. A popular example of a cost function is the Mean Sum of Squares; here, the cost function is simply the variance of a section of the time series [$var(x)$] times the number of points constituting this section (N). In other words, a change point is detected between the segments x_1 and x_2 of a time series, if the sum of the variance of the statistical property of interest, e.g., the mean of the segments, is smaller than the variance of this property of the whole time series; otherwise, no change point is detected. In our application, a maximum of two change points was allowed, one for detecting changes of the mean and one for detecting changes of the variance. The analysis was done with the function *ischange* implemented in Matlab (Release 2018b) with the default threshold.

Consider the time series {2,2,2,4,4,4,4,4,4,4}, where the mean changes from 2 to 4 between $t = 3$ and $t = 4$. The change point analysis algorithm first splits the time series into two segments, x_1 from $t = 1$ to $t = 2$, and x_2 from $t = 3$ to $t = 10$. For both segments, the cost function C is calculated: the first part includes $N = 2$ time points, the second part $N = 8$ time points with $var(x_1) = 0$ and $var(x_2) = 0.5$, hence $C(x_1) = 2 \cdot 0 = 0$ and $C(x_2) = 8 \cdot 0.5 = 4$. The sum of $C(x_1)$ and $C(x_2)$, 4, is then compared to the cost function of the whole time series, $C(x) = 10 \cdot 0.933 = 9.33$. Since $C(x_1) + C(x_2) + k$ are not less than $C(x)$, the algorithm concludes there is no change point when segmenting the time series after $t = 2$. It then proceeds by splitting the time series between $t = 3$ and $t = 4$ and repeats the tests for these segments. Now, both the variance of x_1 and x_2 are zero, hence $C(x_1) + C(x_2) + k < C(x)$ – a change point is detected correctly between $t = 3$ and $t = 4$.

Dynamic Complexity (DC)

Dynamic Complexity (DC) (Schiepek, 2003; Haken and Schiepek, 2010; Schiepek and Strunk, 2010) was developed to identify critical instabilities in short and coarse-grained real-world time series, without further mathematical or parametric assumptions. DC mirrors the increased complexity and sensitivity to noise and perturbations of system dynamics before phase transitions, but also the fact that regimes or attractors of human dynamics realize different degrees of complexity (e.g., emotional rigidity in Major Depressive Disorder or emotional instability in Borderline Personality Disorder). DC is the multiplicative product of a fluctuation measure and a distribution measure applied to discrete time series data with given data ranges [x_{min}, x_{max}] and constant discrete time intervals between the data points (sampling frequency, e.g., one observation per day). The fluctuation measure (F) is sensitive to the amplitudes and frequencies of a time signal, and the distribution measure (D) scans the scattering of values or system states occurring within the range of possible values or system states. In order to identify non-stationarity, DC is calculated within a data window moving over the time series. Because the empirical time series we use in this methods test were collected by daily ratings, we apply a window width of 7 measurement points.

[1] A hypersphere is a high-dimensional sphere, i.e., a set of points at a constant distance from a given point called its center. Here, since we used three embedding dimensions, the hypersphere is equivalent to a sphere.

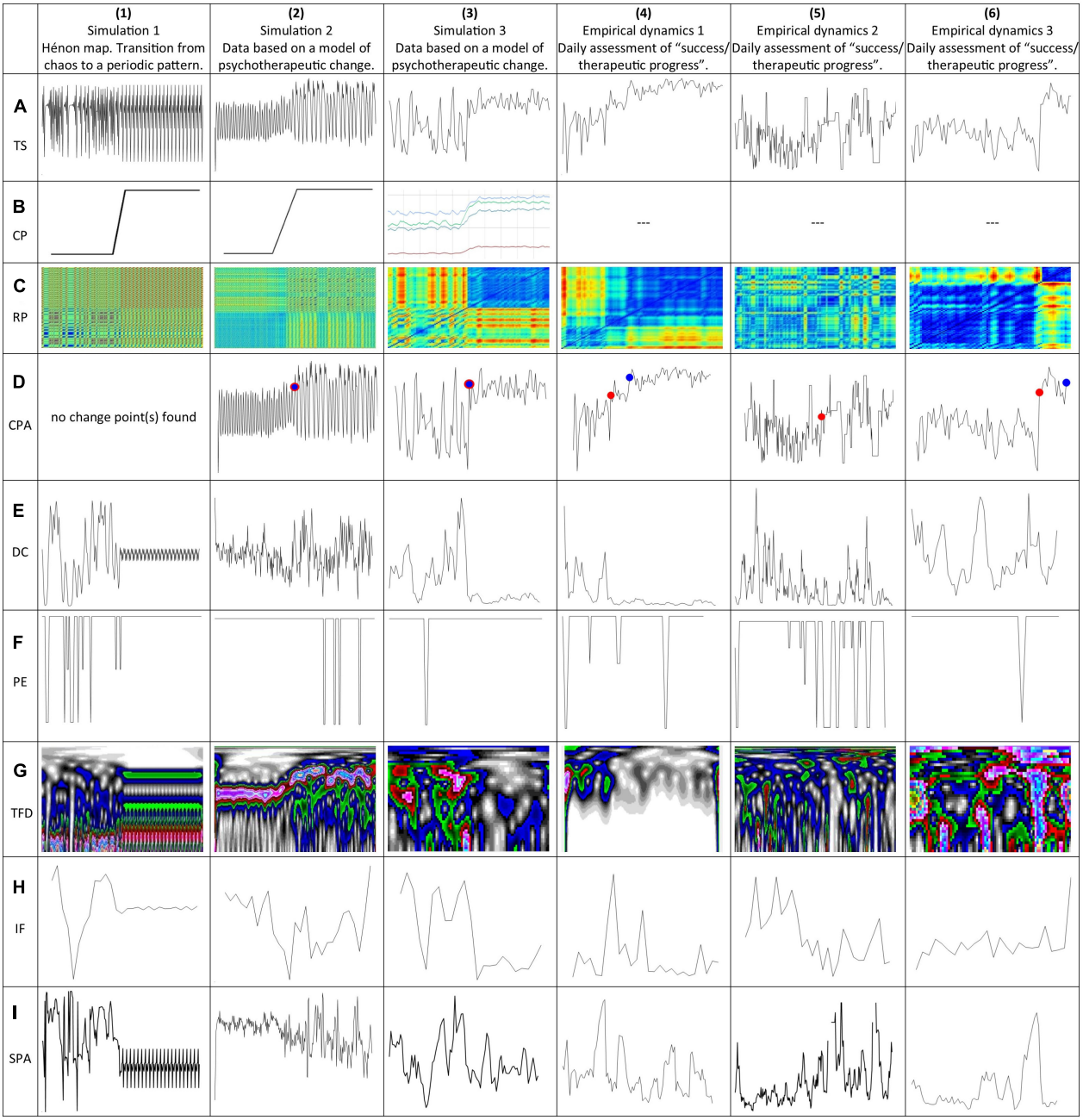

FIGURE 1 | Time series and the applied analysis methods for the detection of critical transitions. All time series were z-transformed to get comparable scales. **(1A)** Transition from a chaotic to a rhythmic regime produced by the Hénon map. **(2A)** Simulation run of a mathematical model of psychotherapeutic change processes with a manually forced parameter shift (time series: "therapeutic progress"). **(3A)** Simulation run of a mathematical model of psychotherapeutic change processes, simulated parameter shifts (time series "insight"). **(4A)** Empirical dynamics of an OCD patient (time series "therapeutic progress"). **(5A)** Empirical dynamics of an MDD patient (time series "therapeutic progress"). **(6A)** Empirical dynamics of an MDD patient (time series "therapeutic progress"). **(1B)** Linear shift of parameter *a* (Hénon map). **(2B)** Linear parameter shifts of all parameters of the model (*a*, *m*, *c*, *r*). **(3B)** Simulated parameter shifts of all parameters of the model (*a*: red, *m*: green, *c*: bright blue, *r*: dark blue). **(1C,2C,3C,4C,5C,6C)** Recurrence Plots (RP) of the time series in line **(A)**. **(1D,2D,3D,4D,5D,6D)** Change Point Analysis (CPA) applied to the time series in line **(A)**; the red dots indicate the identified change points with respect to the mean, blue dots change points with respect to the variance. **(1E,2E,3E,4E,5E,6E)** Dynamic Complexity (DC) applied to all time series in line **(A)**. **(1F,2F,3F,4F,5F,6F)** Permutation Entropy (PE) applied to the time series in line **(A)**. **(1G,2G,3G,4G,5G,6G)** Time Frequency Distribution (TFD) applied to the time series in line **(A)**. **(1H,2H,3H,4H,5H,6H)** Instantaneous Frequency (IF) applied to the time series in line **(A)**. **(1I,2I,3I,4I,5I,6I)** Synchronization Pattern Analysis (SPA) applied to the time series in line **(A)**. CP, (moving) control parameters; CPA, change point analysis; DC, dynamic complexity; IF, instantaneous frequency; PE, permutation entropy; RP, recurrence plots; SPA, synchronization pattern analysis; TS, original time series.

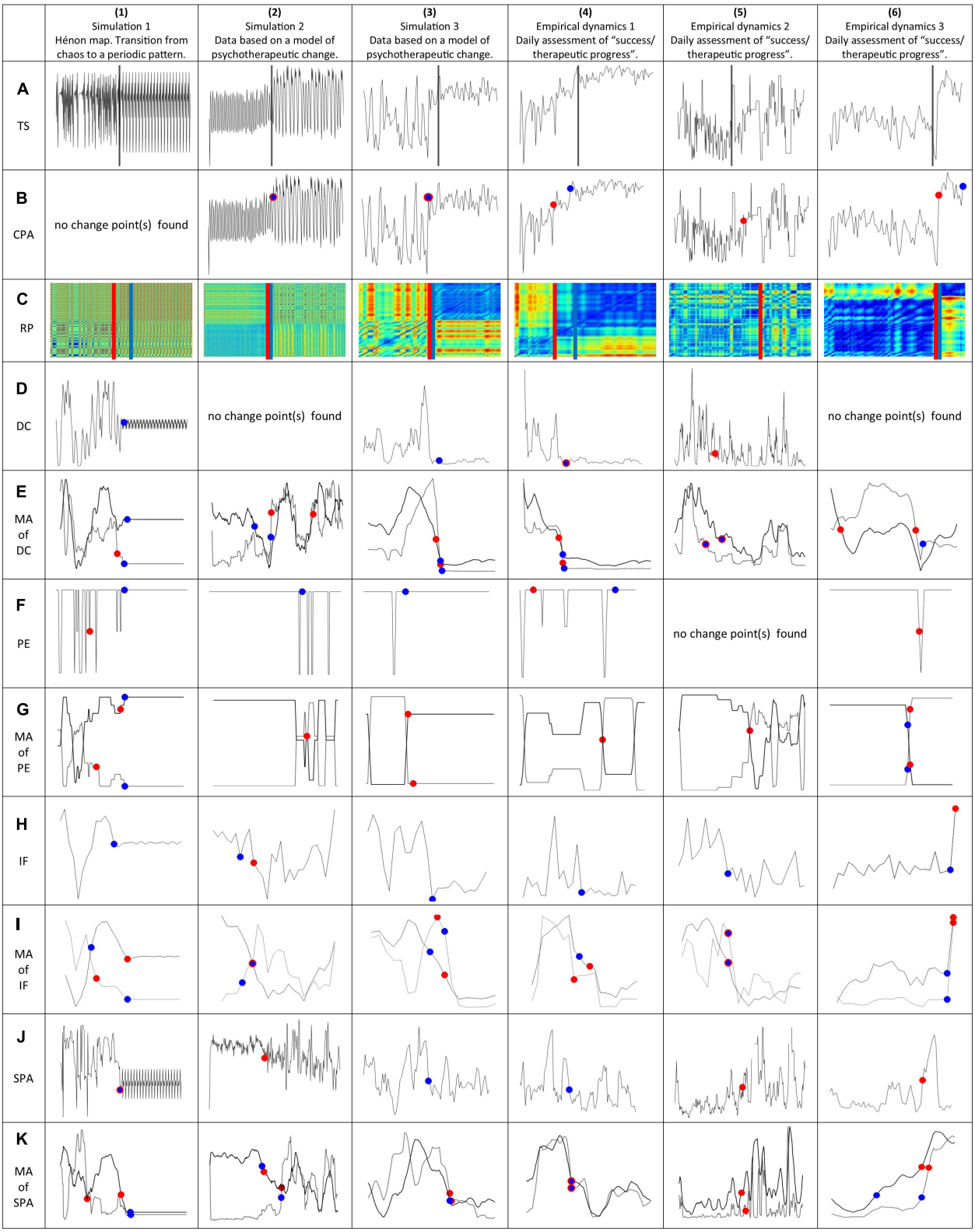

FIGURE 2 | Continued

FIGURE 2 | Time series and the applied second order analysis methods for the detection of critical transitions. All time series were *z*-transformed to get comparable scales. The red dots indicate change points with respect to a change of the mean, the blue dots change points with respect to a change of the variance. **(1A,2A,3A,4A,5A,6A)** Original time series, see line **(A)** in **Figure 1**. The gray bar indicates the mean of all change points. **(1B,2B,3B,4B,5B,6B)** Change Point Analysis (CPA) applied the original time series in line **(A)**. **(1C,2C,3C,4C,5C,6C)** Change Point Analysis (CPA) applied to Recurrence Plots (RP). **(1D,2D,3D,4D,5D,6D)** Change Point Analysis (CPA) applied to Dynamic Complexity (DC). **(1E,2E,3E,4E,5E,6E)** Change Point Analysis (CPA) applied to the moving average (MA, black line) and the moving variance (MV, gray line) of the DC time series (window width: 20 points). **(1F,2F,3F,4F,5F,6F)** Change Point Analysis (CPA) applied to Permutation Entropy (PE). **(1G,2G,3G,4G,5G,6G)** Change Point Analysis (CPA) applied to the moving average (MA, black line) and the moving variance (MV, black line) of the PE time series (window width: 20 points). **(1H,2H,3H,4H,5H,6H)** Change Point Analysis (CPA) applied to Instantaneous Frequency (IF). **(1I,2I,3I,4I,5I,6I)** Change Point Analysis (CPA) applied to the moving average (MA, black line) and the moving variance (MV, gray line) of the IF time series (window width: 5 points). **(1J,2J,3J,4J,5J)** Change Point Analysis (CPA) applied to Synchronization Pattern Analysis (SPA). **(1K,2K,3K,4K,5K,6K)** Change Point Analysis (CPA) applied to the moving average (MA, black line) and the moving variance (MV, gray line) of the Synchronization Pattern Analysis (SPA). CPA, change point analysis; DC, dynamic complexity; IF, instantaneous frequency; MA, moving average; MV, moving variance; PE, permutation entropy; RP, recurrence plots; SPA, synchronization pattern analysis; TS, original time series.

Permutation Entropy (PE)

Like Dynamic Complexity, this measure (introduced by Bandt and Pompe, 2002) identifies complexity in natural, real-world time series without restricting parametric assumptions and with high tolerance for noise. Applied to the dynamics of some chaotic model systems like the logistic map, PE behaves like the positive Lyapunov exponent (Bandt and Pompe, 2002; Schiepek and Strunk, 2010). PE is calculated by studying the frequency distribution of value sequences within a moving window. Patterns are constructed from the data in the moving window on the basis of so-called "words" with a given word length n. All possible words of length n within the moving window are investigated for their rank ordered sequences, and values within a word are recoded in rank order numbers ranging from 0 to $n - 1$. Therefore, a permutation of $n!$ rank number patterns can theoretically be found within a data set with no ties. Permutation Entropy depends on the window width and the word length n. Permutations of word length 3 are calculated for a window width of 7. The calculations were done with the permutation entropy toolbox for Matlab (Ouyang, 2019).

Time Frequency Distribution (TFD)

Time frequency distribution (TFD) is a method to calculate and visualize the frequency of a signal (time series) as it changes with time (Cohen, 1989; Sejdić et al., 2009). In order to identify frequency changes, a moving window approach is implemented. Mathematically, both time t and frequency ω are variables of a distribution $P(t,\omega)$ which describes the amplitude (energy) of the signal at each given t and ω. Here, we use the so-called Stockwell transform (*S*-transform) which is a combination of two common TFD-methods, the Short Time Fourier Transform and the Continuous Wavelet Transform (Stockwell et al., 1996). It preserves the phase information available from the former method but uses the variable (i.e., not fixed) window length of the continuous wavelet method. For visualization, time and frequency are plotted on a plane (x: time, y: frequency) and color-coding is used for the representation of the amplitude (energy) of the frequencies.

Instantaneous Frequency (IF)

The IF of a non-stationary signal is a time-varying parameter that relates to the average of the frequencies present in the signal as it evolves (Boashash, 1992a,b). It reduces the TFD matrix to one dimension by estimating the first conditional spectral moment of the TFD, which represents the average of the frequencies at each time point. IF was calculated using the function *instfreq* implemented in Matlab (Release 2018b).

Synchronization Pattern Analysis (SPA)

An increase of the synchronization of subsystems or components of a system before critical transitions was observed in ecosystems (Dakos et al., 2012), in the emergence of diseases (Chen et al., 2016), and in psychotherapeutic processes (Haken and Schiepek, 2010; Schiepek et al., 2016b). Here we use the absolute (sign-independent) values of the Pearson correlations between the variables of the systems under investigation. For the model systems, the variables were the one shown in **Figures 1** and **2** as well as the other variables of the system; for the empirical time series, the variables were the items constituting the factor shown in **Figures 1** and **2**. The absolute values of the $[N(N - 1)/2]$ correlations (N is the number of variables) are averaged within a moving window (window width = 7). This time varying averaged correlation is a measure of the coherence of the system dynamics.

Quantification of Transitions

The application of these different methods allows to detect aspects of the original time series that go beyond a shift of the mean and/or variance, i.e., changes in the frequency (TFD and IF), recurring patterns (RP), entropy (PE), critical fluctuations (DC), and synchronization (SPA) (**Figure 1**). In order to quantify changes in these aspects, Change Point Analysis is applied to the results of these first step analyses (**Figure 2**). In addition, the Change Point Analysis was applied to smoothed versions of the first step analyses that yielded one-dimensional time series (i.e., the Dynamic Complexity, Permutation Entropy, and Instantaneous Frequency). For the Instantaneous Frequency, a gliding window with 5 points was used, since the methods results in less data points than the original time series, and gliding windows with 20 points for the other methods. These time series of the moving average (MA) and the moving variance (MV) were again analyzed with the Change Point Analysis. As a first approximation to a quantification of the Recurrence Plots, we applied the Change Point Analysis to each line of a Recurrence Plot and used the arithmetic mean of the resulting change points as the change point for the whole Recurrence Plot. The localization and concentration of all second order change points is listed in **Table 1**.

TABLE 1 | Localization and analysis of the change points.

	Hénon (1a)	Simulation 1 (2a)	Simulation 2 (3a)	Empirical case 1 (4a)	Empirical Case 2 (5a)	Empirical Case 3 (6a)
Length of time series	300	300	101	111	282	80
Real phase transition	125–150	100–150	45–58	Unknown	Unknown	Unknown
Change point analysis applied to...						
Original time series	–	145 twice	50 twice	31 and 46	146	65 and 79
DC	152	–	57	38 twice	86	–
MA of DC	147	113 and 240	66 and 69	47 and 50	102 twice	25
MV of DC	151 and 167	148 and 149	69 and 70	50 and 51	69 twice	56 and 59
PE	76 and 153	208	32	13 and 86	–	61
MA of PE	157 and 166	–	45	–	–	54 and 55
MV of PE	105 and 166	226	48	76	165	54 and 55
IF	139	80 and 110	56	60	118	76 and 80
MA of IF	74 and 164	85 twice	53 and 61	53 and 65	114 twice	76 and 80
MV of IF	84 and 164	65	57 and 61	45	123 twice	76 and 80
SPA	145	125	49	45	144	56
MA of SPA	152 and 172	132 and 136	68	51 twice	142	59 and 40
MV of SPA	79 and 173	173 and 174	68 and 69	51 twice	151	59 and 62
RP	135 and 172	129 and 133	51 and 52	33 and 45	173	64 twice
Mean (*SD*)	142 (34)	140 (48)	57 (10)	49 (15)	121 (31)	62 (14)

*The change point analysis was applied to the "second step" measures presented in **Figure 2**. When two numbers are given, one refers to a change point found with respect to a change of the mean, the other found with respect to a change of the variance. When no change point was found, this is indicated by '–'. The means (last line) correspond to the vertical gray bars in **Figure 2(A)**. DC, dynamic complexity; IF, instantaneous frequency; MA, moving average; MV, moving variance; PE, permutation entropy; RP, recurrence plot; SD, standard deviation; SPA, synchronization pattern analysis.*

Time Series of Model and Empirical Systems Used for the Identification of Phase Transitions

In order to identify phase transitions, we prepared six time series from model systems and from empirically assessed psychotherapy processes. The model systems are used to create artificial or simulated phase transitions which fulfill the definition criteria of a phase transition created by at least one moving control parameter. The empirical time series reveal pattern transitions without knowing the responsible control parameters.

The first dynamics [**Figure 1(1A)**] was realized by the Hénon system, which is – like the logistic map – a well know two-dimensional nonlinear map creating oscillatory and chaotic patterns: $x_{k+1} = y_k + 1 - ax_k^2$, $y_{k+1} = bx_k$. 124 iterations were produced with initial values $x_0 = 0$, $y_0 = 0$ and parameter values $a = 1.20$, $b = 0.30$. From iteration 125 to 150 the value of the parameter a was linearly shifted to $a = 1.25$ (step width: 0.002), b was left unchanged.

After this shift, further 150 iterations were produced at constant parameter values. Depending on the shift of parameter a, the dynamics moved from deterministic chaos to a regular rhythm. **Figure 1(1A)** shows the dynamics of variable x.

The second example of a phase transition [**Figure 1(2A)**] was created by a mathematical model of psychotherapeutic change processes (Schiepek et al., 2017). The model includes five variables (S: success and therapeutic progress, M: motivation for change, I: insight and getting new perspectives, E: emotions, represented by a bi-dimensional scale between dysphoric and positive emotions, P: problem intensity and symptom severity), which are interconnected by 16 nonlinear functions constituting the terms of five coupled nonlinear equations (one for each variable). Four control parameters, which can be understood as competencies or dispositions of a patient mediate the interactions between the variables. Depending on their values, the effect of one variable on another is intensified or reduced, activated or inhibited. The parameters are *a:* working alliance and capability to enter a trustful cooperation with the therapist, *c:* cognitive competencies, capacities for mentalization and emotion regulation, *r:* behavioral resources and skills for problem solving, *m:* dispositional motivation for change, self-efficacy, and reward expectation[2]. For creating the chaos-to-chaos phase transition, 100 iterations were simulated with initial values of $S = -40.7$, $M = 7.5$, $I = 100$, $E = 97.6$, $P = 61.5$, and parameters $a = c = r = m = 0.20$, then all parameters were moved by a linear shift from 0.20 to 0.35 between iterations 100 and 150, and after this (from iteration 151 to 300) the parameter values were kept constant. **Figure 1(2A)** represents the variable S ("success and therapeutic progress"), normalized by a z-transformation. During the simulation 5% dynamic white noise was added on all variables.

The third example of a phase transition [**Figure 1(3A)**] was produced by the same model system as the second. The difference is that the parameters were not forced to move by a manipulation, but by a simulation of the parameter dynamics. For this extended simulation model four nonlinear equations for each of the four control parameters were added, which were coupled to the five order parameter equations. At a specific period (between iteration 44 and 57) the control parameters underwent a sudden increase with a steeper gradient as before and after. The initial

[2]www.psysim.at

conditions of the variables were: $E = 97.6$, $P = 61.5$, $M = 7.5$, $I = 100$, $S = -40.7$, the initial values of the control parameters were $a = 0.10$; $c = 0{,}75$; $r = 0{,}46$; $m = 0.53$. The dynamics was driven by a continuous dynamic noise input of 15% on E and P, and of 10% on M, I, and S. The phase transition results from a circular causality between the coupled dynamics of the variables (order parameters) and the control parameters. If this circularity crosses a self-organized threshold a phase transition takes place (Schöller et al., 2018). It occurred between iteration 44 and 57, where the parameters realized a steep increase from $a = 0.11$, $c = 0.72$, $r = 0.48$, $m = 0.55$ to $a = 0.22$, $c = 0.96$, $r = 0.77$, $m = 0.89$. In **Figure 1(3A)** the variable I ("insight/new perspectives") is shown.

The examples four, five, and six are taken from a real-time monitoring of psychotherapeutic change. The male patient (diagnosis: Obsessive-Compulsive Disorder, OCD) of example four was treated in an inpatient setting (combining Cognitive Behavior Therapy with different group and creative therapies) and underwent a sudden gain in OCD- and depressive symptoms after about the first third of the therapy. The assessment was realized by daily self-ratings of the items of the Therapy Process Questionnaire (TPQ, Schiepek et al., 2017) presented by the internet-based Synergetic Navigation System (SNS, Schiepek et al., 2018). The TPQ included 47 items distributed on 7 subscales. In **Figure 1(4A)** the time series of the factor S "success/therapeutic progress" is shown, which corresponds to the factor S of the mathematical simulation model [**Figure 1(2A)**].

The female patient (diagnosis: generalized anxiety disorder, together with different comorbid diagnosis such as somatization, depression, PTSD, OCD, personality disorder with dependent, borderline and histrionic traits) of example five was treated in an outpatient setting (weekly single therapy sessions and a parallel group program, both with focus on Mentalization-Based Therapy adjusted to anxiety disorders) and underwent a transition in her development after about the first half of the therapy. The assessment was also realized by daily self-ratings using a Danish translation of the TPQ, presented by the SNS. In **Figure 1(5A)** the time series of the factor S ("success/therapeutic progress") is shown, which corresponds to the variable S of the mathematical simulation model [**Figure 1(2A)**].

The male patient (diagnosis: Major Depressive Disorder) of example six was – like the patient of example four – treated in an inpatient setting (combining Cognitive Behavior Therapy with different group therapies, especially psychodrama, mentalization-focused therapy, skills training, and creative therapies). He underwent a transition in his development at the very end of the hospital stay. The phase transition was not preceded by a critical instability, but had the shape of a transient relapse, i.e., a short period of deterioration followed by a sudden gain. The assessment also was realized by daily self-ratings using the TPQ. The case and the synergies of different therapeutic experiences preparing the phase transition were described in detail in a single case study (Schiepek et al., 2018). In **Figure 1(6A)** the dynamics of the factor S ("success/therapeutic progress") is shown, which corresponds to the factor S of the mathematical simulation model [**Figure 1(2A)**].

Statistical Analysis

Two methods were used to investigate if the change points were clustered within a certain range of the time series instead of being randomly distributed. Inspired by bootstrapping, random values were drawn from an equal distribution of the length of the respective time series with the *unidrnd* function implemented in Matlab (version R2018b). The number of random values drawn each time was equivalent to the number of change points found in the second order analysis for the respective time series, e.g., for the Hénon map, 23 change points were drawn randomly 100 times from a uniform distribution. These sets of change points are randomly distributed onto the time series and have nothing to do with the phase transition of the time series. When comparing the dispersion of the random change points with the dispersion of the real change points, it is possible to statistically assess if the real change points accumulate, i.e., their dispersion can be tested against randomly spread points.

In a first approach, the interquartile range (IQR) was calculated for the real change points and the 100 sets of random change points for each time series. The IQR describes the number of points within the second and third quartile of the data, i.e., the inner 50% around the median, and is a measure of the dispersion of the data comparable to the variance of normally distributed data. Then, the confidence intervals of the IQRs of the random data were calculated in order to see if the IQR of the real data lies within the confidence intervals.

In the second approach, the dispersion of the change points was assessed by fitting a normal distribution to the change points, using the *fitdist* function with option "Normal" in Matlab. This was done separately for the 100 sets of random change point samples and the real sample for each time series. The width of the normal distribution is characterized by the standard deviation σ. The estimated standard deviation of each fitted normal distribution was used as a measure of dispersion. For the sets of random change points, the mean and the 95% confidence intervals were calculated. If the dispersion of the real change points was significantly lower than those of the random change points, their standard deviation σ would not lie within the confidence interval of σ of the random change points. This would indicate that the real change points cluster around a certain section of the time series, in contrast to random points that have nothing to do with the phase transition period of the respective time series.

RESULTS

Identified Phase Transitions

For each time series, phase transitions were assessed by means of change point analysis applied to several nonlinear analysis methods (**Figures 1**, **2**). A summary of the exact values of the change points is given in **Table 1**, and a visualization in **Figure 3**. Note that the change point analysis alone is not able to identify all changes, e.g., this method did not find a change in the original time series of the Hénon map (1A). The CPA algorithm is designed to detect changes of the variance or of the mean of the time series; it is not able to detect changes of rhythms or

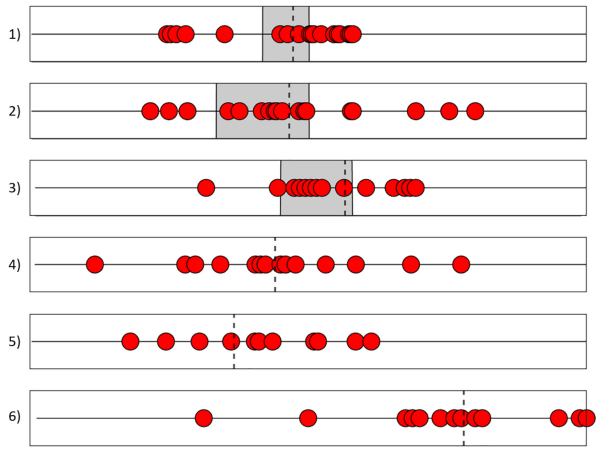

FIGURE 3 | Summary of the change points found by the different analysis methods for all 6 time series (**Figures 1**, **2**). The red dots mark the change points from **Table 1**. The dashed line marks the mean of all change points, and the gray square indicates the known phase transitions in the simulated time series.

patterns in general. For the simulated data (1A/2A/3A), where the points of the phase transitions are known, most analysis methods yielded points within the real phase transitions and were thus able to successfully identify the real points of change. For the empirical time series (4A/5A/6A), the different methods also suggested points that are consistent with the visually visible transitions. The mean of all change points found with the different methods per time series (last line in **Table 1**) lies well within the real phase transition. The combined application of all methods is able to reliably identify the real phase transitions.

Comparison With Random Data

As described in the Section "Materials and Methods," two approaches were applied to test if the change points found in the empirical data are clustered around a certain region of the time series, or if they were randomly distributed. The first method calculated the interquartile ranges (IQR), which describe the dispersion of the change points onto the time series. The confidence interval for the IQRs of the 100 randomly distributed values, and the IQR of the empirical data is given in **Table 2**. For all time series, the IQR values of the original time series are much smaller and lie well outside the confidence intervals of the IQRs of the random data. It can be concluded that the change points of **Table 1** are not randomly distributed but cluster around the real phase transitions of the respective time series.

This result is confirmed by the second analysis method, which fits a normal distribution to the change points (**Figure 4**). **Table 3** gives the mean standard deviations (σ) of the random CP sample and the σ of the real. As anticipated, the mean σ of the random sample is larger than the σ of the real sample for each time series. The large values of the σ were expected since a normal distribution was fitted to equally distributed data. The statistical difference of the σ was assessed by the 95% confidence intervals of the random data. **Table 3** shows that the real σ lie outside the confidence intervals of the random data, i.e., they are significantly different. In other words, the σ of the random change points differed significantly from the σ of the empirical data for all time series.

To exclude effects of a possible oversampling, the tests were repeated without the change points found by the CPA on the gliding mean and gliding variance methods (lines E, G, I, and K in **Figure 2**). The results remained the same, i.e., the IQRs and σ of the real data were well outside the 95% confidence intervals of the random data.

DISCUSSION

A diversity of methods which were expected to be able to identify critical transitions in time series were applied to simulated (Hénon map and two kinds of simulation runs of a mathematical model of psychotherapeutic change) and naturalistic processes (daily self-assessments of three patients during a psychotherapeutic process). The three examples of phase transitions in simulated data were used because in these cases the periods of the transitions are known and can be objectively localized. The following methods were used for time series analysis: Recurrence Plots (RP), Dynamic Complexity (DC), Change Point Analysis (CPA), Permutation Entropy (PE), Time Frequency Distribution (TFD), Instantaneous Frequency (IF), and Synchronization Pattern Analysis (SPA). In a further step we applied CPA to the time series of DC, PE, IF, and SPA, as well as to the moving average and the moving variance of the DC, PE, and IF dynamics. The results show that the methods are convergent in terms of the identification of the critical transitions of the process. The arithmetic average of the change points of these second order dynamics is placed within the windows of shifting control parameters [examples 1, 2, and 3, see **Figures 1(1A,2A,3A)**, **3**], or in close neighborhood to these known shifts. In the empirical dynamics, the change points are placed in a very narrow range compared to the time series length. The convergence of all methods is obvious and highly significant for all time series (**Tables 2**, **3**).

The transitions shown in the RPs of the six test dynamics are evidently coincident with the shift points identified by the other methods. Here we used the CPA of each line in the RPs as a first approximation of a *Recurrence Quantification of Transitions* (RQT, sub-segmentation of the RPs). The TFD patterns shown in **Figures 1(1–6G)** demarcate transitions or interruptions of the frequency amplitudes which can be seen by the naked eye, but there is no immediate quantification available which could be applied to these patterns. The quantification which reduces the pattern to a single time series is given by the IF method.

Different methods applied to the data were able to identify change or transition points, but few of them are able to identify precursors or early warnings of critical transitions. One of the methods, DC, showed increased values just before the transition occurred [see **Figures 1(3E,4E)**], which corresponds to the theoretical concept of critical instabilities preparing phase transitions. There is empirical evidence that increased dynamic complexity precedes transitions and predicts good outcome

TABLE 2 | Analysis of the interquartile intervals (IQR) of the empirical and the random data, expressed as % of the length of each time series.

	Hénon map (1a)	Simulation 1 (2a)	Simulation 2 (3a)	Emp. case 1 (4a)	Emp. case 2 (5a)	Emp. case 3 (6a)
Mean IQR of random data	47%	47%	47%	48%	48%	48%
CI of IQR of random data	[45%, 49%]	[45%, 49%]	[45%, 49%]	[46%, 50%]	[46%, 50%]	[46%, 50%]
IQR of original data	10%	17%	17%	5%	19%	26%

The empirical IQRs are considerably smaller than the random IQRs and lie well outside the 95% confidence interval of the random IQRs. In other words, the random data cover around 45–50% of the length of the respective time series, while the change points of the original data cover only 5% (in the best case) to only 26% (in the worst case), i.e., they are much more concentrated on a certain section of the time series. This indicates a non-random distribution of the change points found by the algorithm. CI, confidence interval; IQR, interquartile range.

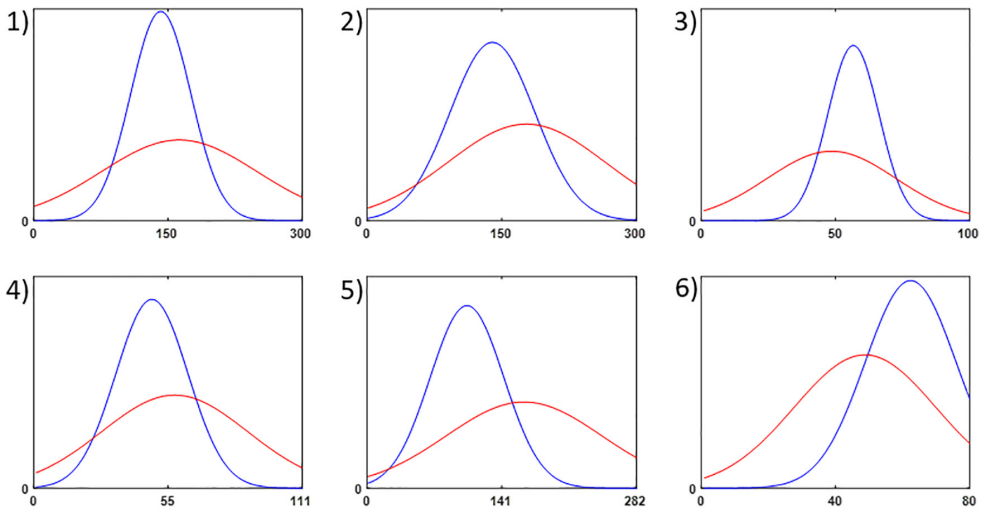

FIGURE 4 | Illustration of the second statistical analysis method: normal distributions were fitted to all sets of change points. The blue line represents the distribution for the real change points found by all methods, and the red line those of the random samples. The width of the fitted distributions allows to conclude that the real change points are much more concentrated (clustered) on a certain section of the time series, since their distributions are considerably narrower.

TABLE 3 | Mean and 95% confidence intervals of the width of the normal distributions (σ) fitted to the random change point samples and the original sample, expressed as % of the length of each time series.

	Hénon map (1a)	Simulation 1 (2a)	Simulation 2 (3a)	Emp. case 1 (4a)	Emp. case 2 (5a)	Emp. case 3 (6a)
Mean σ of random samples	29%	29%	24%	27%	29%	26%
CI of σ of the random samples	[22%, 40%]	[22%, 42%]	[22%,40%]	[22%, 41%]	[22%, 43%]	[22%, 40%]
σ of the original sample	11%	16%	10%	13%	14%	17%

The empirical σ are considerably smaller than the random σ and lie well outside of their 95% confidence intervals. In other words, the random data cover around 22–43% of the length of the respective time series, while the change points of the original data cover only 10% (in the best case) to only 17% (in the worst case), i.e., they are much more concentrated on a certain section of the time series. This indicates a non-random distribution of the change points found by the algorithm. CI, confidence interval; σ, standard deviation (width of the fitted normal distribution).

(Schiepek et al., 2001, 2014; Haken and Schiepek, 2010; Olthof et al., 2019a). For short term predictions of suicidal crises DC may be used as an early warning signal for suicidal attempts or suicidal ideations (Fartacek et al., 2016). It should be noted that in the third empirical case [**Figure 1(6A)**], no increased DC could be found because the "transient relapse" transition was not characterized by preceding critical fluctuations.

Implications for Clinical Practice and Research

Real-time monitoring of the therapeutic progress is getting increasingly popular and has been adopted by mental health providers all over the world (Schiepek et al., 2016c). Evidence is accumulating that the resulting time series are nonlinear and contain discontinuous jumps (see section "Introduction"). Importantly, it has been shown that such discontinuities have a clinical impact. For example, Helmich et al. (2020) report that sudden gains and nonlinear trajectories of the therapeutic progress were significantly more frequently observed in treatment responders. Likewise, increasing fluctuations have repeatedly been shown to improve treatment outcome as they indicate possibilities for the patient to reorganize (Schiepek et al., 2020). Identifying abrupt changes in an objective way is not trivial, especially in cases where the transition is not obvious to the eye. Combining several methods as proposed in this

paper not only guarantees objectiveness but also gives important hints toward the validity of the change points. Moreover, the methods under investigation here allow not only to detect shifts of the mean and/or variance, but other properties like changes of the frequency, or of patterns in general. The study therefore considerably extends the common change point analyses. Once points of transitions have been identified in an objective and valid way, they can be used to look for precursors, i.e., variables that change before the system switches into another state. Successful identification of these indicators preceding change would, of course, be highly relevant for clinical practice. In any way, being aware of a change in the psychological system of a client can guide the practitioner through the therapeutic process as described by the Generic Principles (Haken and Schiepek, 2010).

Limitations and Strengths

This study may be seen as a first step onto the development of an algorithm which could objectively identify phase transitions or phase transition-like phenomena (order transitions). We tested a limited number of methods applied to a limited number of data sets. Next steps have to include much more simulation runs and also much more empirical time series to test the converging results of the methods. A bigger number of cases would allow for a statistical testing of the results. A bigger number of simulation runs with simulated control parameter dynamics (comp. example 3 in our study) would produce some evident and clear-cut transitions, but also ambiguous dynamics and dynamics without transitions. It would be necessary to evaluate the discriminative validity of the methods for differentiating pronounced, less pronounced and non-existing transitions, and also for different degrees of signal-to-noise ratios.

Another limitation of our preliminary work concerns the use of surrogate data testing of the time series analysis (Theiler et al., 1992; Prichard and Theiler, 1994; Rapp et al., 1994; Schreiber and Schmitz, 2000; Schreiber and Schmitz, 2008). Random surrogates, which are created by random shuffling of the original series of the data points, destroy the nonlinear characteristics of a time series but preserve the linear ones, even the frequency distribution by creating phase-randomized surrogates. Based on a multitude of surrogates, a statistical test of the results from the original time series against the distribution of the results from the surrogates is possible. This was not done in our study because its focus was on the comparison of methods and their convergent validation, not in the statistical testing of the results using big numbers of cases and surrogate data distributions. Both will be realized in the next step of the validation project.

We included a very restricted number of methods which were known as appropriate for the analysis of short non-stationary real-world time series. Other methods exist (see the section "Perspectives") and should be tested for their sensitivity to detect critical transitions.

The strength of the study is to combine proved methods for the identification of critical transitions in simulated and empirical data sets. This goes beyond what is called "eye balling" and allowed for a first evidence of the comparative robustness and validity of the methods.

Perspectives

Most of the methods used in this convergent validity test seem to be promising and are used in routine process monitoring of psychotherapy. In the SNS, DC, PE, RP, and SPA are implemented (Schiepek et al., 2018). Beyond this, many other methods are available for the identification of critical transitions and related early warnings, which were published in different disciplines (e.g., climate research, ecology, brain dynamics, and physiology). In a current research project based on about 1.000 simulation runs and 1.000 empirical cases – each of which was documented by multiple time series assessed by daily TPQ-ratings – the methods will be tested for feasibility and for sensitivity to detect transitions.

Basically, all methods for the identification of chaotic dynamics can be used for the identification of transitions from regularity or noise to chaos or from one type of chaos to another. One is the titration of chaos with added white noise of increasing standard deviation, until its nonlinearity gets undetected by a particular indicator at a limiting value of the noise limit (Poon and Barahona, 2001). Others are the well-known Lyapunov exponents, or more specifically, the spectrum of Lyapunov exponents, one for each dimension of a m-dimensional system (Wolf et al., 1985; Rosenstein et al., 1993). More important than static measures of chaoticity are dynamic ones, which calculate the largest Lyapunov exponent of a time series within a gliding window (Kowalik et al., 2001) and by this identify changes of predictability (exponential divergences of nearby trajectories in an attractor) (Kowalik et al., 1997), or the Pointwise Correlation Dimension (Skinner, 1992; Skinner et al., 1994) which uses each vector point of an attractor as a reference for calculating the correlation dimension D2. By this, it allows for the identification of transitions in dynamic processes (Kowalik et al., 1997). Developments of methods for the estimation of fractal dimensionality (D2) and Lyapunov exponents for the identification of non-stationary systems are presented in Strunk and Schiepek (2006; for applications in psychotherapy research see Haken and Schiepek, 2010; Schiepek et al., 2016a).

Scheffer et al. (2009) and Dakos et al. (2012) report on a variety of indicators of next to transition dynamics, such as increased variance, critical slowing down with indicators like increased autocorrelations or lag1 autoregression coefficients, as well as extended skewness, kurtosis and conditional heteroscedasticity in the distribution of the time series values. Although the authors refer primarily to catastrophe theory, critical instability with increased sensitivity to perturbations and critical slowing down – the relaxation to stable attractors takes longer time after perturbations – are core concepts of far-from-equilibrium phase transitions as developed in Synergetics (Haken, 1977). Whereas critical instabilities can be identified by measures like DC, the detection of increased autocorrelation may require much longer time series (Bence, 1995) which usually are not available in psychotherapy research. Further indicators of critical slowing down are spectral reddening (higher variation at low

frequencies) close to transitions, and increases in short- and mid-term memory measured by Detrended Fluctuation Analysis (Dakos et al., 2012).

An interesting characteristics of system dynamics approaching an attractor shift is flickering which is not only produced by internal or external perturbations or by sensitivity to noise, but by transient, short-term shifts between different alternative regimes before the system breaks its symmetry into one of these attractors (Schiepek et al., 2017). Methods proposed by Dakos et al. (2012) for the identification of dynamics driven by repeatedly crossing the domains of attraction of alternative states is threshold AR(p) models and potential analysis. Potential analysis is a technique for deriving the shape of the underlying potential of a system assuming that a time series may be approximated by a stochastic potential equation including a term for polynomial potentials of even order. The order of the best-fit polynomial in essence reflects the number of potential system states identified along the time series (Livina et al., 2011; Dakos et al., 2012). Finally, the emergence of scale-invariant power-law distributions (de Felice and Giuliani, 2020) is a precursor of transitions.

Chen et al. (2016) proposed an inconsistence index based on the computational method of Hidden Markov models. The inconsistence index measures the probability of a time point in a discrete time series being a switching point from a stationary Markov process to a time-varying Markov process. Healthy, before-transition states should be stationary Markov processes with high resilience and robustness to perturbations, whereas pre-transition states to diseases should be low resilient and more sensitive to perturbations (time-varying Markov processes). The inconsistence index passes a threshold during a pre-transition stage from a healthy pre-disease state to a disease state. Molenaar et al. (2009) used an extended Kalman Filter with iteration and smoothing to estimate time-varying parameters in non-stationary (non-ergodic) state-space models of empirical data.

One of the prominent methods for the identification of pattern transitions is RP. Unfortunately, the existing quantitative indicators of the features of a RP characterize the plot as a whole (Recurrence Quantification Analysis). They grasp important features as the percent of a plot filled with recurrent points (%Recurrent), percent of recurrent points forming diagonal lines (%Determinism), the Shannon information entropy of the line length distribution (Entropy), the length of the longest line segment (MaxLengths), and a measure of the paling of recurrent points away from the central diagonal (Trend) (Giuliani et al., 2001; Webber and Zbilut, 2005). Wallot et al. (2016) proposed sophisticated methods of Recurrence Quantification Analysis for multidimensional time series. However, up to our knowledge indicators of sub-segments and shifts of the dynamic qualities are not yet available. Calculating the change points of each line in the RPs may be a first approximation to *Recurrence Quantification of Transitions* (RQT), but other quantitative indicators of shifting recurrence patterns and sub-segmentation strategies should be developed, what is the topic of one of our currents projects.

There are promising methods which are not based on point-like measures but on spatio-temporal data sets. A method proposed by Goswami et al. (2018) transforms the sequential data of a spatial grid into a sequence of probability density functions which can be analyzed, e.g., by networks of recurrence probabilities. Ecosystems evidently undergo specific self-organized spatial patterns as they approach a critical transition, detectable by the analysis of coherences in the spatial structure (Scheffer et al., 2009). A method for the identification of changing coherence patterns is Spatiotemporal Stochastic Resonance (STSR) which measures the stability of spatial patterns displaying resonance-type dependency on noise amplitudes (Hütt et al., 2002).

The application of these methods onto psychotherapy and other psychological data sets needs for modifications, developments, and rigid testing. In a next step, they should be applied to big data sets created from computer simulations and empirical process monitoring with the aim of selecting the most valid ones on the way to a robust algorithm for detecting phase transitions and their precursors.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

AUTHOR CONTRIBUTIONS

GS wrote the manuscript and supervised the process of data analysis. HS and KV realized the time series analysis. GF, SS, and MB provided the data of an empirical case and discussed the manuscript. CF discussed the manuscript and checked the writing. WA contributed to the organization of the research process and provided the data of an empirical case. All authors contributed to the article and approved the submitted version.

FUNDING

One of the empirical time series was taken from the EPICLE project, which was funded by the Velux Foundation, Denmark (Grant No. 10384).

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 23 October 2020
doi: 10.3389/fpsyg.2020.475525

Long-Term Effects of Home-Based Family Therapy for Non-responding Adolescents With Psychiatric Disorders. A 3-Year Follow-Up

Egon Bachler[1], Benjamin Aas[2], Herbert Bachler[3], Kathrin Viol[1], Helmut Johannes Schöller[1], Marius Nickel[4] and Günter Schiepek[5]*

[1] Institute of Synergetics and Psychotherapy Research, University Hospital of Psychiatry, Psychotherapy and Psychosomatics, Paracelsus Medical University, Salzburg, Austria, [2] Psychosomatics and Psychotherapy, LMU Ludwig Maximilians University Munich Hospital for Child and Adolescent Psychiatry, Munich, Germany, [3] Medical University Innsbruck Institute for General Medicine, Innsbruck Medical University, Innsbruck, Austria, [4] Clinic for Psychiatry and Psychotherapeutic Medicine, Medical Univerity Graz, Graz, Austria, [5] Department of Psychology, Ludwig Maximilian University of Munich, Munich, Germany

OPEN ACCESS

Edited by:
Julian A. Rubel, University of Giessen, Germany

Reviewed by:
Tim Kaiser, University of Greifswald, Germany
David Rosenbaum, Tübingen University Hospital, Germany

***Correspondence:**
Egon Bachler
dr.egon.bachler@t-online.de

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *30 May 2019*
Accepted: *06 October 2020*
Published: *23 October 2020*

Citation:
Bachler E, Aas B, Bachler H, Viol K, Schöller HJ, Nickel M and Schiepek G (2020) Long-Term Effects of Home-Based Family Therapy for Non-responding Adolescents With Psychiatric Disorders. A 3-Year Follow-Up. Front. Psychol. 11:475525. doi: 10.3389/fpsyg.2020.475525

Objective: Home-based treatment of families with low socio-economic status and multiple psychosocial problems (multi-problem families, MPFs) is gaining importance in clinical social epidemiology and health services research. The sustainability of the treatment is of special importance in order to breach transgenerational effects.

Methods: We examined outcome, effect size, and clinical significance of home-based treatment for 84 multi-problem families in a naturalistic setting. 48 of the families were available for a follow-up after 3 years. The baseline characteristics of these family systems included low collaboration, an increased family adversity index, minors with high rates of child psychiatric disorders, a high prevalence of comorbidity, low relational family functioning, and adolescents who refused any form of treatment or had unilaterally terminated different forms of treatment before. The home-based family therapy consisted of one or two face-to-face counseling sessions per week over an average of 28.8 months (*SD* = 19.2). The symptoms and competence of the adolescents, the caregivers, and the family structure were assessed with 13 variables.

Results: All variables showed significant improvement rates (pre- vs. post- treatment) with medium to high effect sizes (mean of Cohen's *d* = 1.04, range = 0.34 – 2.18). All variables showed a sustained or even further improvement at follow-up.

Conclusion: This study provides evidence of statistically (p), practically (d), and clinically (RCI) significant changes in symptom and competence-related variables among adolescents and caregivers in MPFs with sustainable long-term effects in the 3-year follow-up period.

Keywords: follow-up, effect size, reliable change index, outcome, adolescents', family therapies, multi-problem families, Child Behavior Checklist

INTRODUCTION

Multi-Problem Families

Multi-problem families (MPFs) are families who experience a multitude of complex problems in various areas of life. Their difficulties usually arise on the level of the family system (psycho-social factors) as well as in their environment (low socio-economic status) (Tausendfreund et al., 2016; Bachler et al., 2018). They range from parenting issues, psychiatric problems, troubled relationships, to financial debt, health-, and housing-related issues, as well as repeated contact with social authorities or the criminal justice system (Tausendfreund et al., 2016). It has been stressed that the difficulties these families experience in their attempt to handle everyday life originate in the interaction between socio-economic and psycho-social problems (Tausendfreund et al., 2016). With regard to the mental health of the minors in these families, several issues are commonly reported in these families (Egle et al., 2004; McLaughlin et al., 2012; Coore Desai et al., 2017): Maladaptive functioning of the parents, disrupted parenting and attachment behavior, associated deprivation conditions, inadequate educational methods, and deficient cognitive, social or emotional developmental support; sometimes even neglect, abuse, and maltreatment. According to Kessler et al. (2010), parental mental illness, child abuse, neglect, and maladaptive functioning of the parents are the strongest predictors of mental disorders, accounting for the occurrence of 29.8% of all disorders in 21 countries. In MPFs, these childhood adversities are highly prevalent, interrelated, and associated with impaired family functioning (Bachler et al., 2018).

Treatment of MPFs Families

Therapists and social workers aiming to help MPFs families are confronted with a complex system with several levels of dysfunction, spanning psychological, neurobiological, social, and economic issues. This poses a serious challenge for the development of successful therapeutic principles in the treatment of MPFs (Bachler et al., 2017). For a long time, it was assumed that parents and adolescents in MPFs were unable or unwilling to collaborate in a goal-directed manner; they were referred to as "unwilling, involuntary or mandated clients" (Bachler et al., 2016). In the categorization of Friedlander et al. (2011), who identified four groups of individuals or families in psychotherapy ("customers," "plaintiffs," "visitors," and "hostages"), MPFs are found in the "plaintiffs," "visitors," and "hostages" categories. These groups are characterized by low problem perception and tend to experience problems externally, which greatly affects the degree of goal-directed collaboration. Collaboration and treatment alliance, however, are the strongest predictor of outcome in psychotherapy (Polaschek and Ross, 2010). The therapeutic alliance and treatment expectancy are impacted negatively (Hamilton et al., 2011) by the main characteristics of caregivers and adolescents in MPFs, including general deficits in social skills, poor object relation, a history of poor familial relationships, strong defensive attitudes, a hopeless stance, low psychological mindedness, high level of resistance, negativism, and hostility (Castonguay and Beutler, 2006). Moreover, pre-treatment characteristics like low socio-economic status, Axis II disorders, and previous non-response are usually predictive of completing the psychotherapeutic treatment without significant clinical improvements (Reuter et al., 2016).

Multi-problem families received relatively little attention in psychotherapy research or in the research on child and adolescent health prior to the 1990s. This was highlighted in a bibliographical survey by Ensminger and Fothergill (2003), who report that only 1% of 11,505 articles between 1990 and 2000 in the Child Development Journal addressed families with low socio-economic status. In the last 15 years, different empirical studies about various forms of home-based treatments in the fields of youth welfare and child and adolescent psychiatry show medium-to-high effect sizes for the treatment of MPFs families, despite multiple chronified psychosocial problems (Curtis et al., 2004; Liddle et al., 2009; Bachler et al., 2016; Tausendfreund et al., 2016). Assuming an average effect size of (d) = 0.51 for family therapy (Sydow et al., 2007), an effect size of.55, as found for the Multisystemic Therapy (Curtis et al., 2004), shows the potential of successfully reaching the families. Still, the range of effect sizes (0.27–0.77) reported by Liddle et al. (2009) for Multidimensional Family Therapy suggest considerable differences in treatment response. Preferably, the therapeutic work is done in the home of the families ("in-home" or "home-based" treatment). This setting helps reducing the high dropout rates of 40% within the first 2 weeks for community mental health services (Principe et al., 2006).

Long-Term Effects of Treatment of Multi-Problem Families

The psychological disorders/problems in MPFs are of great sociopolitical importance as they imply considerable costs for society. These include "undefined burden" like the loss of productivity or inability to work, and "hidden burden," e.g., delaying treatment and healing through revolving door effects, and worse social networks (WHO, 2001). However, Bachler et al. (2018) showed that childhood adversities do not predestine children to an irreversible fate: The outcome of therapy is more powerful than the influence of adverse factors on the development of child psychiatric symptoms. Enduring effects of the treatment are of high relevance for both the individual and the society.

While the feasibility of effective treatment of MPFs has been elaborated in the previous paragraphs, the long-term effect of these treatments has hardly been in the focus of research. A follow-up on child psychiatric treatments has been examined for only a few clinical groups of adolescents, such as those with bipolar disorders (Inder et al., 2017), former adolescent self-injurers (Groschwitz et al., 2015), or in cases of anorexia nervosa (Amianto et al., 2017). Amianto et al. (2017) demonstrated that 8 years after treatment, the rate of complete remission was 42, 67.8% improved, and 18.6% worsened. The long-term effects of home-based treatment have been examined with regard to drug abuse and delinquency. van der Pol et al. (2018) found that 3 years after treatment, delinquency and cannabis abuse had significantly declined, although no difference was

found between multidimensional family therapy and cognitive behavioral therapy. In another study, dealing with juvenile sexual offenders, the effects of multisystemic therapy were more sustained than for group cognitive behavioral therapy (Letourneau et al., 2013). Johnides et al. (2017) examined the long-term effect of multisystemic therapy on caregivers of serious juvenile offenders in a 20-year follow-up. Caregivers in multisystemic therapy showed 94% fewer felonies and 70% fewer misdemeanors than caregivers in the individual therapy setting.

Aims and Hypotheses

This study is part of a research project on empirically supported principles in the treatment of MPFs families ("What works for whom and why?"). Here, we assess the effects of the home-based Outpatient Family Therapy (OFT) on a variety of psychosocial factors, including a follow-up analysis to examine the stability of the treatment effects after 3 years. The research questions were as follows: (1) Does OFT improve the functioning, mental health, and social abilities of the clients? (2) Do these effects sustain 3 years after the treatment? The analysis plan differentiates between self-rating measures (behavioral and psychiatric assessment of the minor) and external ratings (other variables).

(1) Self-rated variables

   a. OFT will decrease the problematic behavior of the minor.
   b. OFT will decrease the psychiatric symptoms of the minor.

(2) Externally rated variables

   a. OFT will increase the global functioning of the minor, the caregiver, and of the family.
   b. OFT will increase the social and working skills of the minor and the self-sustainability of the family.
   c. OFT will decrease general risks (adversities) of the family.
   d. OFT will increase the achievement of individual therapeutic goals.

MATERIALS AND METHODS

Study Design

This is a longitudinal study with a naturalistic design. The study was conducted by a research group from two institutes, the Institute of Psychoanalysis and Family Therapy (IPT) in Salzburg, Austria, which operates in two Austrian federal states and in Upper Bavaria, Germany, and the Institute of Synergetics and Psychotherapy Research of the Paracelsus Medical University, Salzburg, Austria. The study was part of a larger research project about the treatment of MPFs funded by the EU.

The Youth Welfare Office regularly puts families forward to the Institute of Psychoanalysis and Family Therapy for treatment if other treatments have failed or have been refused, if a child or adolescent is threatened with placement in a therapeutic institution, or if the court has ordered therapeutic intervention. Overall, the families show a wide range of psychosocial problems and imminence of various forms of child endangerment. Therapy was provided randomly by 34 therapists (21 female, 13 male) out of a total of 170 psychotherapists of the Institute of Psychoanalysis and Family Therapy, servicing 650 families at any one time. The 34 therapists who treated the families of this study were responsible for an average of 2.4 families (SD = 1.3). They knew that their case was part of an empirical study but did not know the hypotheses of the study.

The therapists assessed the collaboration and the families' treatment expectancy as part of the routine assessment (for details see Measures). Additional data were collected by external clinical psychologists in the families' homes before and after treatment, and 3 years after the treatment (follow-up). The external clinical psychologists had received training in data collection and were not employs of either institute.

Confidentiality was guaranteed and written informed consent was provided by all participants (or their legal representatives) according to the Declaration of Helsinki.

Measures

In the following, we provide basic information on the questionnaires and assessments used in the study. Details can be found in the supplement. Six measures were applied before and after treatment: collaboration, treatment expectation, three individual therapeutic goals (ITG), and the mental health of the minor. Seven measures were also assessed three years after treatment (follow up): behavior of the minor, family adversities, relational functioning within the family, global functioning of the minor, global functioning of the caregiver, social self-sustainability of the family, and social/working skills of the minor.

Self-Rating Measures

CBCL

The symptoms and behavior of the minors were assessed by the Child Behavior Checklist (CBCL) and the Mannheim Parental Interview (MPI). The CBCL (Achenbach, 1991) is a widely used international scale and provides information on three domains of competence (activity, social competence, school). In addition to a total score, it comprises eight subscales (somatic, social problems, social withdrawal, anxiety/depression, alertness, schizoid/obsession, dissocial behavior, aggressive behavior), and allows for the assessment on externalizing and internalizing behavior.

MPI

The MPI (Esser et al., 1989) is a structured and standardized clinical interview, which indicates psychological disorders and their severity. The 37 questions covering child and adolescent psychiatric symptoms combine a cumulative child-psychiatric symptom score and different ICD diagnoses.

Externally Rated Measures

CP and VH

The assessment of the collaboration (Collaboration Scale, CP, Bachler, 2013) and treatment expecation (Treatment Outcome

Expectation, VH, Bachler, 2013) are integral parts of routine assessments. Collaboration is assessed by a narrative interview which the therapist conducts with the family. The therapist then estimate the degree of collaboration with the family reaching from 1 (excellent) to 5 (impossible). The Treatment Outcome Expectation is rated by the therapist together with the caregiver and the adolescent ranging from 1 (high) to 5 (low) expectations.

ITGs

The ITG rating follows the ITG module of the Psychotherapy Basic Documentation (PSYBADO, Heuft and Senf, 1998). It provides an individual definition of three therapeutic goals that are important both to the family and the Child Welfare Office and rated independently by the family, the external psychologist, and the Welfare Office. The final score is the average of the ratings.

FAI

The Family Adversity Index (FAI) (Rutter and Quinton, 1977) measures familial psychosocial stress. Based on five items (chronic disharmony in the family, low socioeconomic status, cramped living quarters, parental criminality, and mental disorder of the primary caregiver), the resulting total value ranges from zero to a maximum of five. Values $\geq$2 reflect considerable socio-familial stress. The FAI is rated by the external psychologist based on the anamnestic information they received.

SSF/SSAMJ

The Social Self-Sustainability Skills Scale (SSF) records the social self-preservation ability ranging from 1 (very good) to 5 (massively restricted). The SSF describes – independently of social support systems – factors such as social assistance, working capacity, and the family income earned through this work. The SSAMJ records the school and work ability of the minors and defines the extent to which age-appropriate social behavior and performance can be achieved (Bachler, 2013). SSF and SSMAJ are rated by the external psychologist.

GAF/CGAF/GARF

The Global Assessment of Functioning scale, based on the DSM-IV, is frequently employed in psychotherapy studies as a measure of disability and psychosocial dysfunction (Saß et al., 2003). The questionnaire comes in an adult version (GAF) and a version for children aged 4 and above and adolescents (CGAF). The Global Assessment of Relational Functioning (GARF) rating scale assesses the psychosocial level of family functioning through a clinical interview. It covers the three dimensions problem solving, organization, and emotional climate (Stasch and Cierpka, 2006). The three questionnaires are rated by the external psychologist.

Sample

Calculation of Sample Size

Prior to the beginning of the study, the number of samples needed was calculated. The lowest effect size in former research (Bachler et al., 2016) was $d = 0.35$. To achieve a power of.8, 66 subjects were needed to get a significant result for a two-sided paired t-test ($\alpha = 0.05$). We decided to collect data from 90 families due to the unknown dropout rate in the follow-up period.

Definition of the Sample

The sample was defined consecutively, i.e., all families put forward with a treatment order by the Youth Welfare Office starting from 4/2008 were included in the study, unless they met an exclusion criteria (see below). The probability of being included in the representative random sample was therefore the same for each family as required by the Equal Probability Selection Method.

From the 131 families contacted during the study period (**Figure 1**), 36 cases were excluded because they were either purely diagnostic clarification cases (clearing), or the caregivers had insufficient language skills, or the age of the child at the start of treatment was below 4 years. Further three families refused to give written informed consent due to data protection reasons related to the Youth Welfare Office. The treatment of 8 families was prematurely terminated within the first 24 weeks of therapy. In consequence, the final sample size for the pre vs. post treatment assessments was 84. Out of these 84 families, 48 also participated in the follow-up (28 families could no longer be contacted due to a change of residence, and 8 declined to collaborate further). Corresponding to the intention-to-treat principle, families that discontinued the treatment after 6 months (long-term) were nevertheless included in the evaluation.

All the adolescents were so-called non-responders, i.e., they had refused treatment or had received different forms of treatment with early dropout (within the first 2 months). None finished treatment voluntarily.

Sample Characteristics

The mean age of all clients that were approached for follow-up measurements was 10.65 years (range = 4–17; median = 10.5; SD = 3.52), with 29 female and 56 male clients and a mean treatment duration of 28.8 months (SD = 19.2). The mean age at follow-up was 14.0 years (range = 7–20). All children were diagnosed with mental illness (**Table 1**), mostly with behavioral and emotional disorders beginning in childhood and adolescence (F90-98; ICD 10, 2006). They were coded according to the Mannheim Parent Interview (MPI) (Esser et al., 1989) into four spectra (rounded percentages): 34% were diagnosed with dissocial disorder, 26% with emotional disorder, 27% with hyperactivity, 6% with alcohol and drug abuse/dependency, and 6% with other ICD-10 diagnoses (F84, F95, and F98). More than half of the children (N = 58) had comorbidities; 31 of the adolescents were assigned to two, and 27 to more diagnoses. The mean of the Child Behavior Check List (CBCL, see Measures and **Table 2**) total score was 48.5 (SD = 23.7). The transformed T-value ($T \geq 67$) of our sample is at the 95–98% percentile, i.e., only 2% of the children in the total population show such high values. The T-value is nearly two standard deviations above the mean of the standard sample (T-value 50, 1 SD = 10), with a T-value above 1 standard deviation representing the cut-off value between healthy and sick (Achenbach, 1991).

The primary caregivers were between 32 and 55 years of age (M = 43.6; SD = 6.1). 93.6% of the primary caregivers were female. The rate of single parents (divorced, widowed, separated, living alone) was 53.2%. The proportion

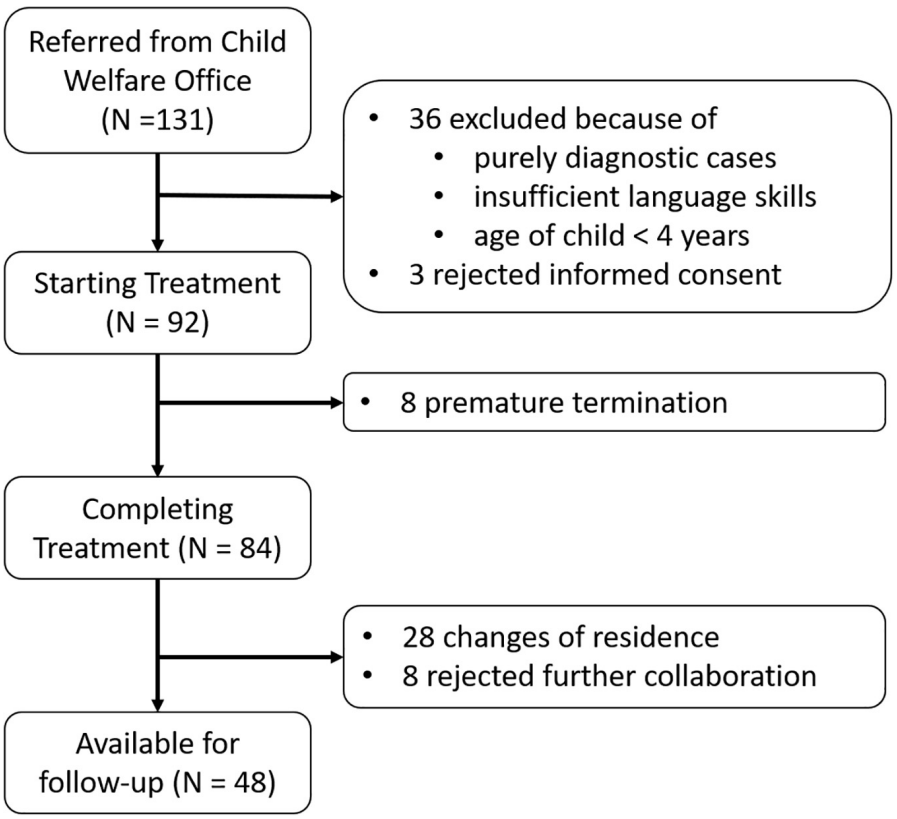

FIGURE 1 | Flow chart showing the composition of the resulting sample. OFT: outpatient family therapy. For the pre vs. post comparison, 84 families were available; for the differences to the follow-up, data of 48 families could be reached.

of primary caregivers with mental illnesses was 63% (29–35% were personality disorders with a moderate to disintegrated structure level).

The families showed a high level of vulnerability to socio-familial burdens: Social problems such as poverty and unemployment as measured by the FAI (FAI, see Measures and **Table 2**) at the start of care was $M = 2.24$. According to Rutter and Quinton (1977), the cut-off value for a "significant socio-familial burden" is ≥ 2. Likewise, the social functioning of the family was low, as indicated by the GARF (Stasch and Cierpka, 2006).

Outpatient Family Treatment

The treatment method applied in this study is therapeutic Outpatient Family Treatment (OFT), which was developed as a disorder-oriented, therapeutic outreach intervention for families with multiple problems. It combines structural family therapy interventions (Minuchin and Fishman, 1983), psychoanalytic elements of mentalization-based psychotherapy (Fonagy et al., 2006), and structural psychotherapy (Rudolf, 2006). The aim of OFT is to improve the intra-psychological and interpersonal ego-structural skills such as perception of self and others, defense and affect regulation, attachment, and communication (cf. Opd Arbeitskreis 2, 2006, Axis IV) in the primary caregiver and in the minors. Special regard is payed to the general parenting skills of the primary caregivers. The program incorporates the principles for the treatment of personality disorders and structural psychotherapy (i.e., aiming at the improvement of ego-structural competencies) that were identified by the APA Division 12 task force: a strong working alliance, therapist ability to repair alliance ruptures, collaboration on goals, and a high level of therapist activity (Critchfield and Benjamin, 2006). The therapists in this study had different therapeutic backgrounds (36% in psychodynamic therapy, 29% in family therapy, 19% in cognitive-behavioral therapy, 16% in other therapeutic approaches) and had received specific training in the technical characteristics of the OFT approach based on a curriculum. A manual is kept describing the OFT performed in the study. There are obligatory interventions: (A) fostering goal consensus and collaboration by fostering treatment expectancy and giving support to solve problems in order to reduce the impact of adversity factors, (B1) focused work on organization and bonding, communication, and emotional climate in the families, (B2) focused work on individual goals defined with adolescents and parents, (C) the process of completion by continuously decreasing the intensity and frequency of the treatment to foster the autonomy of the adolescents and the functioning of the family system. In addition, the following are important: repair of alliance, management of countertransference, and an interpersonal focus on the improvement of social skills.

TABLE 1 | Demographics, diagnostics, and pre-symptom scores of the sample.

Characteristics	*M* (*SD*) or%
Family	
Treatment duration (month)	28.8 (19.2)
Very low SES	37%
Chronic Disharmony	72.4%
Child/adolescent	
Age	10.65 (3.52)
Sex	34.0% female
ICD diagnosis	100%
Alcohol and drug addiction	6%
Emotional disorder	26%
Dissocial disorder	34%
ADHD	27%
other diagnoses	6%
Comorbidity	69%
Primary caregiver	
Drug addiction	19.7%
Uneducated	29.4%
Mental disorder	63%
Age	43.6 (6.1)
Sex	93.6% female
Single parents	53.2%

M, mean; SES, socio-economic status; SD, standard deviation.

The level of therapeutic directiveness and support is initially high and multimodal; treatment length and frequency are adaptive. The average number of therapy hours in the institute and for the sample amounted to 2.5–3 h per week, mostly divided into two sessions. Supervision was given by experienced clinicians who did not belong to the team of therapists once a week.

Analysis

The collected data were analyzed with SPSS 21.0 and Matlab (R2018b). First, two repeated measures multivariate analysis of variance (rMANOVA) using Wilks-Lambda were performed to assess the combined change of the measures over time. One rMANOVA included the pre/post difference with all measures as dependent variables, and time as the independent factor with two levels (pre/post). The other rMANOVA included only the seven measures where a follow-up score was available. As *post hoc* tests, paired *t*-tests were used to test significant differences between pre- and post-treatment scores, between pre-treatment and follow-up scores, and between post-treatment and follow-up scores of each of the measures. The significance level was set to.05 for all tests and the false-discovery rate (FDR) algorithm by Benjamini and Hochberg (1995) was applied using a Matlab toolbox (Fachada and Rosa, 2018).

Cohen's effect size d was calculated for the mean difference between pre- and post-treatment scores and then divided by the pooled standard deviation σ_{pooled} according to $d = (M_{\text{post}} - M_{\text{pre}})/\sigma_{\text{pooled}}$. Following Morris and DeShon (2002), the pooled standard deviation was calculated by relating the standard deviations of the pre and post treatment values (σ_{pre} and σ_{post}) to their correlation $r_{\text{pre/post}}$:

$$\sigma_{\text{pooled}} = \frac{\sigma_{\text{pre}}\sqrt{2(1-r_{\text{pre/post}})} + \sigma_{\text{post}}\sqrt{2(1-r_{\text{pre/post}})}}{2}.$$

Reliable changes were analyzed using the Reliable Change Index method (RCI; Wise, 2004) according to $\text{RCI} = \frac{M_{\text{pre}} - M_{\text{post}}}{\sigma_{\text{pre}}\sqrt{2(1-\alpha)}}$, where α is the reliability of the measure (Cronbach's α). Applying a 5% criterion, an $\text{RCI} \geq 1.96$ and $\text{RCI} \leq -1.96$ thus identified the cases that have reliably changed ($p < 0.05$).

All variables of the Children Behavior Check List were represented by *T*-norms based on German norms.

RESULTS

Preliminary Analysis

First, we were interested if there were any differences between the families who were available for the follow up ($N = 48$) and those that were not ($N = 37$). Both groups did not significantly differ in terms of age, gender, collaboration, behavior of the child (CBCL score), or any of the other pre/post change scores, neither at the beginning of treatment nor in the pre/post difference. Only the length of the two groups' respective treatment was significantly different: families participating in the follow-up had a significantly shorter treatment duration of 24.9 months compared to 34 months for the non-participating families [$F(1,83) = 4.92$; $p = 0.029$]. In addition, Levene's test showed no violation of homogeneity (except the difference scores of SSAMJ), suggesting no structural differences between the two groups. Overall, the results suggest that the drop-out group did not systematically differ from the follow-up group.

Improvements During Treatment and Follow-Up

The repeated measures MANOVA of the pre/post scores was significant [$F(13,32) = 13.14$, $\Lambda = 0.16$, $p = 0.001$, $\eta^2 = 0.84$], suggesting a difference in the combined dependent variables. Also, the rMANOVA of the variables with follow-up scores revealed a significant change over time [$F(14,10) = 6.28$, $\Lambda = 0.10$, $p = 0.003$, $\eta^2 = 0.90$]. In consequence, paired *t*-tests were conducted to determine which of the variables showed significant changes, and – in the case of the rMANOVA with follow-up scores – where in time the significant changes took place.

As shown in **Table 2**, all measures showed significant improvements during treatment (pre vs. post) with generally large effect sizes (Cohen's d, $M = 1.04$; range = 0.34 – 2.18). The highest effect sizes were obtained for the three ITG ($d = 2.1$ – 2.2). Without the ITG, the mean effect size was still $d = 0.70$. Importantly, the improvements even continued after treatment: the comparison of scores from before treatment with follow-up scores show a sustained consolidated treatment effect: the mean effect size between pre and follow-up increased to $d = 0.73$ (without ITG). When comparing the outcome measure after treatment with the scores from the follow-up, two of the variables, the global functioning of the caregiver and the FAI, even showed

TABLE 2 | Pre-treatment scores, post-treatment scores, and follow-up scores of all measures with the effect sizes of the changes.

	Pre-treatment			Post-treatment			Follow-up			Effect sizes of change (Cohen's d)		
										pre vs. post	pre vs. follow-up	post vs. follow-up
Variable/Measure	***M***	***SD***	**95% CI**	***M***	***SD***	**95% CI**	***M***	***SD***	**95% CI**	***d***	***d***	***d***
Collaboration (CP)[t]	2.99	0.95	[2.8;3.2]	2.25	1.04	[2.0;2.5]				0.74**		
Treatment expectation (VH)[t]	3.44	1.10	[3.2;3.7]	2.83	1.11	[2.6;3.1]				0.55**		
Individual therapeutic goal 1 (ITG-1)	−1.58	0.61	[−1.7;−1.5]	0.33	1.08	[0.1;0.6]				−2.18**		
Individual therapeutic goal 2 (ITG-2)	−1.55	0.59	[−1.7;−1.4]	0.19	0.98	[−0.02;0.4]				−2.14**		
Individual therapeutic goal 3 (ITG-3)	−1.56	0.61	[−1.7;−1.4]	0.18	0.95	[−0.03;0.9]				−2.17**		
Mental Health of the child (MPI)	13.70	8.24	[12;16]	7.93	8.13	[6.2;9.7]				0.67**		
Family adversity index (FAI)	2.24	1.13	[2.0;2.5]	1.85	1.08	[1.6;2.1]	0.92	0.83	[0.7;1.2]	0.35**	1.28**	0.91**
Global functioning of the caregiver (GAF)	59.88	1.48	[5.6;6.3]	67.98	1.60	[6.5;7.2]	78.09	1.65	[7.3;8.3]	−0.52**	−1.13**	−0.59**
Global functioning of the minor (CGAF)	53.48	1.49	[4.9;5.8]	68.48	1.93	[6.3;7.4]	78.51	1.53	[7.4;8.3]	−0.86**	−1.40**	(−0.34)
Relational functioning of the family (GARF)	24.13	0.83	[2.2;2.7]	34.78	0.94	[3.2;3.8]	40.85	0.99	[3.8;4.4]	−1.19**	−1.81**	(−0.37)
Child behavior checklist (CBCL)	48.52	23.71	[43;54]	29.58	20.07	[25;34]	24.63	19.4	[19; 30]	0.86**	1.22**	(0.20)
Social self-sustainability (SSF)[t]	3.14	0.98	[2.9;3.4]	2.79	1.12	[2.5;3.0]	2.48	1.20	[2.1;2.8]	0.34*	0.44*	(0.08)
Social and Working Skills of the minor (SSAMJ)[t]	3.85	1.00	[3.6;4.1]	2.76	1.19	[2.5;3.0]	2.48	1.13	[2.2;2.8]	0.98**	1.22**	(0.12)

**: $p < 0.05$ **: $p < 0.001$ of the paired t-test, corrected for multiple comparisons. [t] inverted scale, e.g., high scores = low expectations.*

a second significant improvement [GAF: $t(46) = -3.6$; $p < 0.001$; FAI: $t(46) = 4.8$; $p < 0.001$]. **Figure 2** summarizes the findings of the key measures, displaying the scaled pre, post and follow-up scores.

Even though the CBCL total score (post-treatment vs follow-up) did not show further significant improvement after treatment, **Table 3** shows that the values of the subscales "attention deficits" and "aggressive behavior" significantly decreases further during the 3-year follow-up period. The subscale "somatic problems" *in*creased significantly during the follow-up period. However, the somatic problems did not deteriorate compared to the pre-treatment score.

The development of the minors was assessed by three scales, the CGAF, the MPI, and the CBCL. While the CGAF is based on an external rating, the latter two measures are self-rated (or rated by the parents). In contrast to findings from previous research (Minami et al., 2007), we did not obtain larger effect sizes for the self-report questionnaires ($d = 0.67$ for the MPI and $d = 0.86$ for the CBCL) compared to the externally rated CGAF ($d = 0.86$).

Clinically Relevant Changes

In order to investigate if the above-mentioned changes were also clinically relevant, the Reliable Change Index (RCI) was computed for the four main measures: CBCL, GAF, CGAF, and GARF. The respective percentages of improved and recovered clients is shown in **Table 4**. Scores that changed more than 1 SD were categorized as "improvement," changes larger than −1 SD as "deterioration," and values between −1 and 1 SD as "unchanged."

The deterioration score for all clinical parameters was low (range: 0 – 4.3%), and all variables showed further improvements in the follow-up period. The global functioning of the caregivers (GAF) showed the highest percentage of an "unchanged status" in the treatment period (91%), while the minors' rate of unchanged participants was considerably lower (CGAF, 76%). This suggests a higher impact of OFT on adolescents in comparison to their caregivers. The largest improvement rate was achieved for the relational functioning of the families (GARF, 26% unchanged).

Most importantly, there were no deteriorations of the minors in the follow-up period. 45.8% of adolescents with unilateral

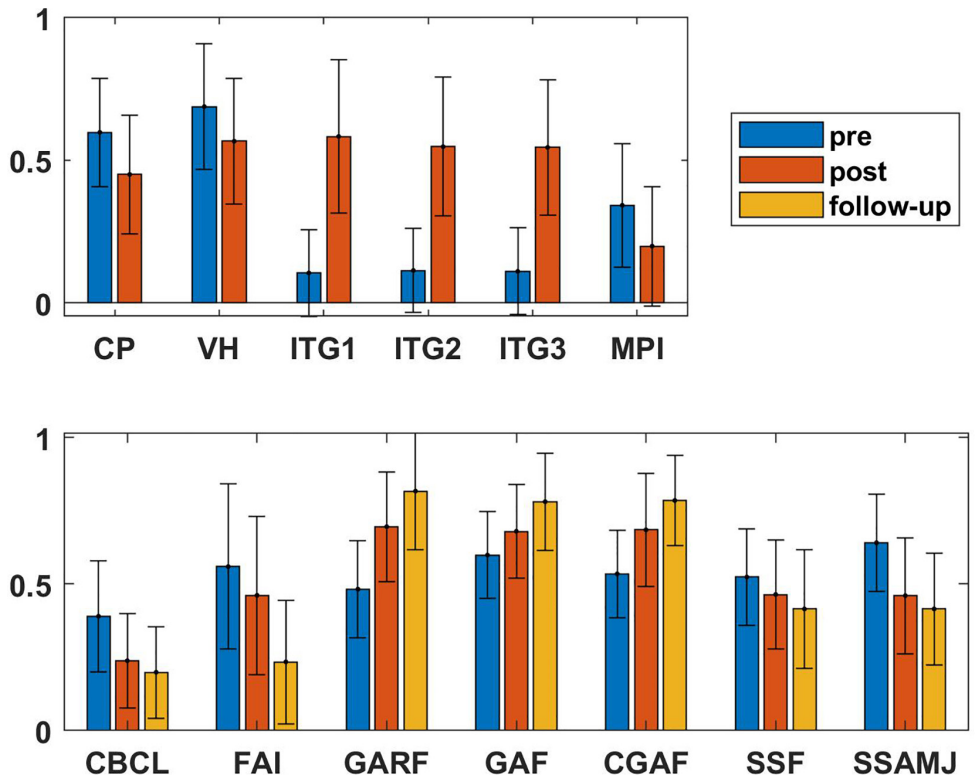

FIGURE 2 | Visualization of the pre, post, and follow-up values of the scores of the multi-problem families. To allow comparability, all values were rescaled by the range of the respective questionnaire, i.e., 1 corresponds to the maximum and 0 to the minimum values. By this, the pre/post/follow-up differences are comparable. Symptom scores like MPI, CBCL and SSAMJ significantly decreased during treatment and continued to decline in the 3-year follow-up period. Accordingly, the scales assessing the functioning of the families increased (GAF, CGAF, and GARF). The measures for general risks of the families (FAI and SSF) decreased, too. The largest change was achieved in the ITG of the families. The scores for treatment expectation and collaboration are reversed, i.e., high score represent low expectations and missing collaboration. CBCL: Children Behavior Check List, CGAF: global functioning of the child, CP: collaboration, ITG: ITG, FAI: family adversity index, GAF: global functioning of the caregiver, GARF: global relational functioning of the family, MPI: Mannheim Parental Interview, SSF: (impaired) Social Self-Sustainability of the family, SSAMJ: (impaired) Social and Working Skills of the Minor, VH: treatment expectation.

TABLE 3 | The table shows the changes of the subscores of the Children Behavior Checklist (CBCL) over time.

	Pre vs. Post			Pre vs. Follow-up			Post vs. Follow-up		
Variable/Measure	***M***	***SD***	***d***	***M***	***SD***	***d***	***M***	***SD***	***d***
Social withdrawal	1.32	2.56	0.51**	1.98	2.75	0.75**	0.19	2.02	(0.09)
Somatic problems	0.75	2.22	0.36*	0.14	2.48	(0.07)	−0.58	1.75	−0.40*
Anxious depressive	2.74	3.89	0.65**	4.10	3.92	0.97**	0.65	2.43	(0.19)
Social problems	1.52	2.18	0.59**	2.00	1.98	0.77**	0.52	1.95	(0.23)
Schizoid-obsessive	1.12	1.86	0.69**	1.31	2.05	0.74**	−0.02	1.30	(−0.02)
Attention deficits	2.31	3.62	0.64**	3.33	3.67	0.91**	0.71	2.28	0.22*
Dissocial behavior	1.53	3.06	0.43**	2.17	3.97	0.61**	0.00	3.62	(0.00)
Aggressive behavior	4.88	7.29	0.64**	8.77	7.38	1.22**	2.25	5.39	0.35*
Other problems	3.74	3.93	0.88**	4.17	4.99	0.93**	0.31	2.93	(0.09)
Internalizing	4.55	6.64	0.66**	5.85	7.00	0.88**	0.21	4.28	(0.04)
Externalizing	6.41	9.8	0.61**	10.9	10.5	1.09**	2.25	8.30	(0.25)

*N = 84 for the pre vs. post difference, N = for the pre and post vs. follow up differences. *p < 0.05, ** p < 0.001 d, effect size (Cohen's d); M, mean; SD, standard deviation.*

termination in previous treatments (non-responders) showed clinically significant and sustainable improvement of the total score of the CBCL and CGAF (pre vs. 3-year follow-up) in the setting of the OFT.

DISCUSSION

This study provides evidence of statistically (*p*), practically (*d*), and clinically (*RCI*) significant changes in symptom and

TABLE 4 | Reliable Change Index (RCI) and the percentages of improved (>1 SD), deteriorated (<−1 SD), and unchanged patients.

		Pre vs. Post			Pre vs. Follow-up		
Measure	***RCI***	**% Improved**	**% Unchanged**	**% Deteriorated**	**% Improved**	**% Unchanged**	**% Deteriorated**
CBCL	25.44	38.8	58.8	2.4	45.8	54.2	0.0
GAF	2.10	8.3	90.5	1.2	38.3	61.7	0.0
CGAF	2.11	21.7	76.1	2.2	54.2	41.7	4.2
GARF	0.69	69.6	26.1	4.3	70.8	29.2	0.0

CBCL, Child Behavior Check List; CGAF, Global Assessment of Functioning (child); GAF, Global Assessment of Functioning (caregiver); GARF, Global Assessment of Relational Functioning (family).

competence-related variables among adolescents and caregivers in MPFs with sustainable long-term effects in the 3-year follow-up period.

Improvement of Caregivers, the Family System, and Children's Mental Health (External Rating)

At the beginning of treatment, the relational functioning (GARF) of the families was at a very low level ($M = 24.1$). The effect size of the treatment (pre vs. post) was high ($d = 1.19$) and well above the effect size of $d = 0.87$ reported by Zander et al. (2001). However, the post treatment score was still in the dysfunctional range. Importantly, the relational functioning within the family further improved after treatment, resulting in an unremarkable follow-up score ($M = 41.0$). This shows a sustainable, high improvement of family functioning (competence related improvements in problem solving, family organization, and emotional climate), which is preventive for the further development of siblings and the family as a whole.

These changes might be related to the psychological health of the caregivers (GAF), which improved with a high effect size ($d = 0.52$) from 59.9 to 68.0 and almost reached the cut-off value for health (70.0) after treatment. After three years, the caregiver's competence scores were within the range of healthy adults. The GAF has an important binding-based mediator function with respect to the relational functioning (GARF) and the mental health of the kids (GAF). Parents with low personality functioning have significant vulnerability-relevant skills-related deficiencies (Bornstein and Bradley, 2003). Mötteli et al. (2018) found in a propensity-score matching analysis of 19 months a change in the GAF for mentally ill adults from 41 to 67 in home treatment. The improvement of mental health of the caregiver was related to a moderate improvement of the self-sustainability of the family (SSF), i.e., the caregiver's ability to work. The complex interactions between psychological health of the caregivers, family functioning, and the mental health of the minors calls for further empirical research.

In a sample of the same institute that had received the same treatment (start of treatment 2009, end of treatment 2013, $N = 376$, Bachler et al., 2016), the effect sizes (Cohen's d) between pre and post treatment: CP = 0.46 (0.67); VH = 0.53 (0.51); ITG = 1.45 (1.46); FAI = 0.35 (0.45), MPI = 0.47 (0.81); GAF = 0.52 (0.52); CGAF = 0.86 (0.87); GARF = 0.70 (1.04). The effect sizes of the study presented in this manuscript are given in parentheses. The sample of the other group was defined in the same way: randomly, consecutively (i.e., all families put forward with a treatment order by the Youth Welfare Office starting from 4/2008 were included in this study), and with the same exclusion criteria as the present study, but no follow-up data is available for this group.

Taken together, the general improvement of the family is reflected by the decreased risk factors of the families: The FAI, which comprises multiple psycho-social adversities such as chronic disharmony in the family, low socio-economic status, cramped living quarters, parental criminality, and mental disorder of the primary caregiver, decreased significantly. The highest effect sizes were achieved for the ITG ($d = 2.1 - 2.2$), confirming once more the importance of personalized treatment (Schiepek et al., 2016).

Likewise, improvement of the children's social, school, and work capabilities (SSAMJ) are essential for therapeutic work, success at school and at work, and lead to higher social mobility (Lund et al., 2011).

Improvement of Children's Mental Health (Self-Rating)

The problematic behavior of the children (CBCL value) of the mixed-gender group of our study before treatment was clinically conspicuous, while the post value was almost within the normal range. Our study shows moderate to high effect sizes for externalizing disorders (comprising the subscales social problems, dissocial behavior, and aggressive behavior). These changes are of particular importance since Bellani et al. (2012) demonstrated the association between externalizing disorders in minors and Axis I and Axis II disorders in adulthood. Even the three subscales of the CBCL Dysregulation Profile (CBCL-DP), which comprises anxious-depressive, attention deficits, and aggressive behavior, improved with medium effect size. Holtmann et al. (2011) showed that CBCL-DP scores are not only pediatric symptoms, but also provide an early marker for developmental risks, persistent deficits in affect, self-regulation, suicidality and social behavior. Cross-sectional studies show strong empirical evidence of increased rates of children with CBCL-DP suffering as adults 24 years later from disorders of anxiety, mood, personality, and disruptive behavior as well as marked impairment, suicidality, and multiple DSM-IV diagnoses

(Reef et al., 2011). The odds ratio is 11.6 that children with a high CBCL-DP are likely to abuse drugs and suffer from severe psychiatric disorders (Althoff et al., 2010; Bellani et al., 2012).

The score for the children's psychiatric symptoms (MPI) also showed a clear improvement with medium effect-size ($d = 0.67$), The scores of the MPI and the CBCL indicate sustained competence-related improvements of the adolescents. This is of great importance since it allows to interrupt the transgenerational pattern of dysfunctional parenting.

Practical and Clinical Significance of the Improvements

Reviews and meta-analyses of studies on psychotherapy outcomes show that 5–10% of patients in psychotherapy experience a worsening of symptoms, and 15–25% evidence no clinically significant improvements (Stulz et al., 2007). In a study of 1,776 patients, Jacobi et al. (2011) showed worsening rates of 0.8–4.3% and a high-symptomatic completion value ($M_{pre} + \leq 1\ SD$) indicating "no change" in 11.2% of the patients. In our study, we calculated the RCI for the four most important variables (CBCL, GAF, CGAF, and GARF). All showed considerable post-treatment clinical improvements among the participants. The rate of deterioration post-treatment was not higher than in outpatient psychotherapy (Jacobi et al., 2011), but 29.2–61.7% remained unchanged. This indicates differential effects of OFT on different subgroups of MPF as it was shown in previous research (Bachler et al., 2017).

The effect sizes of our study in comparison with different studies on Multi-Systemic Treatment (MST) and Multi-Dimensional Family Therapy (MDFT) demonstrate the following: OFT treatments in the field of child and adolescent psychiatry like MST or MDFT show low to medium effect sizes of $d = 0.55$ (MST, Curtis et al., 2004) or $d = 0.27$–0.77 (MDFT, Liddle et al., 2009). The pre/post comparisons in our study show moderate to high effect sizes with a mean of $d = 1.04$ and a range of $d = 0.34 - 2.18$, which are considerably larger than those reported for MST and MDFT. Even without the ITG, which had considerably larger effect sizes than the other variables, the mean effect size of $d = 0.7$was still at the upper end of the range reported by Liddle et al. (2009).

Sustained Effects of Treatment

Compared to these therapeutic interventions, the treatment in our study consists of fewer sessions per week but a longer treatment duration. Compared to the mean of 40 sessions in MST and MDFT, the families in our study received a mean of 115 sessions (SD = 19.2) over an average period of 28.8 months. This could hint at treatment effects due to longer treatment duration and dosage. Indeed, Lindfors et al. (2015) showed that long-term therapy resulted in higher and more persistent outcome scores with more ego-structural changes than short-term therapy. Knekt et al. (2017) also showed that long-term therapy was more effective for patients with low-level personality functioning. The duration of therapy matters where structural effects are concerned: Bozzatello and Bellino (2016) showed that structural effects in outpatient therapy for personality disorders persisted in the follow-up period after the termination of therapy. This long-term effect can also be observed in all our variables, in case of GAF, FAI, and two subscales of the CBCL even with further significant improvements.

Limitations

The study is not a randomized-controlled trial but follows a naturalistic design. In a strict sense, this consequently prevents us from making causal interpretations about the effectiveness of the treatment. However, the main aim here was to evaluate if there was a prolonged effect of the treatment, i.e., the effects would not disappear once the treatment had ended. While "placebo" or "no treatment" control groups do not seem ethically justifiable in this context, future studies should include at least a "waiting list" control group to confirm the assumption of "no change" without treatment that is implied in our analyses.

Although we tried to apply an intention-to-treat analysis instead of a completer analysis, this was not possible because eight families terminated treatment unilaterally and were no longer available for assessment. Still, we included all families who had received treatment for at least 24 weeks.

In addition, there could be a confirmation bias in the data, although the hypotheses of the study were not known to the therapists. We tried to further reduce this by assigning data collection of most variables to external psychologists.

CONCLUSION

Our study shows that adaptive disorder-related treatments can achieve sustainable changes in MPFs, which are referred to as "hard to reach." In addition, the data show that even adolescent non-responders can successfully be treated irrespective of pretreatment characteristics such as low socio-economic status, low level of personality functioning (CBCL dysregulation syndrome), and earlier unilateral termination of treatment.

The present study is a contribution to "treatment aptitude" or "suitability" research (Norcross, 2011) and seeks to improve the adaptive indication (individualization of treatment in psychotherapy) of "tailor made treatments" for MPFs. Klein et al. (2003) showed that it is difficult to change combined disorders of social behavior and dissocial conspicuous behavior in the inpatient setting of youth welfare services. Efficacy studies also point to the low effect sizes in the psychotherapeutic treatment of children and adolescents with combined multimorbid externalizing or dissocial symptoms (Cincaya et al., 2011). Integrated multi-modal treatments with high structural and process qualia can close this supply gap, especially for patients, adolescents, and families with low-level functioning, and achieve medium to high effect sizes and sustainable high follow-up effects.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects. All subjects gave their written informed consent in accordance with the Declaration of Helsinki. The study received ethics approval from the Government of Salzburg (Amt der Salzburger Landesregierung, Ref. 3/02, Fanny-v.-Lehnert-Strasse 1, 5020 Salzburg, Austria). Further ethics approval from an institutional IRB/Ethics Committee was not required as per applicable institutional and national guidelines and regulations.

AUTHOR CONTRIBUTIONS

BA was responsible for statistics, EB for taking care of the clinical psychologists from the data collection team, MN, KV, HS, and HB for the data evaluation, and EB and GS for writing the manuscript. All authors contributed to the study design, literature and references.

FUNDING

We are grateful to the European Union, the State of Salzburg, the State of Upper Austria and the Government of Upper Bavaria for their financial support (EFRE funds J00111) for this empirical research on MPFs.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.475525/full#supplementary-material

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