Language Style Matching in Psychotherapy: An Implicit Aspect of Alliance

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In an attempt to operationalize an implicit aspect of the therapeutic alliance, this article proposes the use of the innovative, objective, and time-efficient analysis of language style matching (LSM; Niederhoffer & Pennebaker, 2002). LSM, defined as the degree of similarity in rates of function words in dyadic interactions, is thought to reflect the extent to which conversational partners are automatically coordinating language styles to achieve a common goal. Although LSM has often been researched in the context of everyday conversations, little is known about the matching of clients and therapists' language style in the psychotherapy process. To demonstrate the clinical usefulness of the LSM approach in psychotherapy, 2 exploratory examples of the application of LSM in long-term psychoanalytic treatments are provided. First, LSM analyses per session and per speaking-turn are described for psychotherapy data of 140 sessions of 7 long-term psychoanalytic treatments in relation to outcome measures. Then, a case study is described in which LSM is triangulated with an observer-rated measure of working alliance in relation to outcome measures. These 2 demonstrative empirical examples were explorative in character and illustrate how LSM might tap into an implicit aspect of the therapeutic relationship, different from the working alliance measured by observers, and relevant for treatment outcome. Future larger-scale psychotherapy studies into the relationship between these implicit aspects of the alliance and treatment outcome and relevant clients and therapists' variables are warranted.

Public Significance Statement
Language style matching may offer unique opportunities for the examination of therapist–client interactions within and between sessions, particularly those implicit aspects which elude conscious awareness of the therapist, client, or outside observer, that nonetheless exert an influence on treatment outcome.

The therapeutic alliance reflects interactive elements of the counseling process to which both the client and the therapist contribute, (e.g., Horvath & Bedi, 2002). It can be thought of as a measure of *fit* or *match* (Kantrowitz et al., 1989), and varies across time depending on the contribution to it by both parties, something that is an ongoing result of the interaction between the client and therapist (Safran & Muran, 2000). Although the exact active ingredients of the alliance and how they predict treatment outcome requires further elucidation, it has been established that higher levels of client–therapist matching are associated with better relationship outcomes (e.g., Håvås, Svartberg, & Ulvenes, 2015). In counseling, the therapist explicitly tries to build alliance

by matching the client (Baldwin, Wampold, & Imel, 2007), for example, by mirroring the client's affective state with facial expressions of distress to convey sympathy (Blairy, Herrera, & Hess, 1999). In successful treatments, therapists tend to accommodate to the language of the client more than in unsuccessful treatments (Hölzer, Mergenthaler, Pokorny, Kächele, & Luborsky, 1996). A therapist's matching is meant to communicate that the client has been seen, is understood, and can be contained (Fonagy, Gergely, Jurist, & Target, 2002).

Despite the fact that therapists might explicitly try to adapt to an individual client, there might be several reasons why clients might try to match their therapist. For example, research on verbal synchrony in dyads with a power differential indicates that individuals with a lower social status (i.e., clients) tend to modify their word choice to match a conversational partner of a higher status (i.e., therapist; Danescu-Niculescu-Mizil, Lee, Pang, & Kleinberg, 2012). Moreover, when clients present with high levels of symptoms/severe psychopathology, they may lack a sense of self-esteem and therefore easily adapt to the therapist. However, it could also be argued that these clients' therapists might feel more need to scaffold their interventions, and make more effort to merge with these clients, closely tracking their subjective experiences. Arguably, the question of who is adapting to whom is irrelevant given that psychotherapy has been likened to dancing the tango (Bucci & Maskit, 2007), where continuous interactions make it purposefully unclear who is leading whom. This mutual adaptation process in psychotherapy implies no leadership or symmetry per se, only that influence is bidirectional.

Limitations of Current Measures of Alliance

There is disagreement regarding which modes of assessment most accurately assess the therapeutic alliance. Previous alliance research depends heavily on self-report measures. Self-report measures are likely to be affected by the client or therapist's ability, awareness, and motivation to report on the therapeutic process. Also, the results might differ, depending on who completes the self-report measure (e.g., Hatcher, Barends, Hansell, & Gutfreund, 1995). To complement the client's and therapist's view of the alliance, several observer-rated process coding systems have been developed (e.g., Comparative Psychotherapy Process Scale; Hilsenroth, Blagys, Ackerman, Bonge, & Blais, 2005).

Despite the popularity of these measures in counseling, most observer-rated measures are not easily applied to long-term psychotherapies. Many rely on the availability of video recordings of sessions. Also, these observer-based coding systems are generally very time-intensive, which is especially problematic when investigating therapeutic processes as they unfold over years of long-term psychoanalytic treatment. Furthermore, observer-based measures tend to assess explicit behaviors, or narratives as potential mechanisms of change (McWilliams, 2011), but do not examine the implicit nature of the relationship patterns, that are important in psychoanalytic psychotherapy (e.g., Andrade, 2005).

Measuring Implicit Aspects of the Alliance

Implicit automatic aspects of the alliance may affect therapeutic change on a scale similar to, or even greater than, the conscious or observable elements of the alliance itself (McWilliams, 2011). Arguably, what is most relevant in the psychotherapy process is not verbal content per se, but the manner in which content is communicated (e.g., Hölzer et al., 1996; Reyes et al., 2008). Computerized text analyses of the verbal clinical exchange might offer a method of capturing this implicit aspect of the therapeutic relationship (e.g., Babcock, Ta, & Ickes, 2014).

Language Style Matching

To operationalize the interactive and implicit aspects of the alliance in psychoanalytic psychotherapy, the Language Style Matching (LSM) metric is proposed, which is based on computerized text analyses performed using the software Linguistic Inquiry and Word Count (Gonzales, Hancock, & Pennebaker, 2010; Ireland & Pennebaker, 2010). Rather than content-based aspects of language (e.g., using the client's description of feeling "livid" rather than "angry"), LSM represents the degree to which two people are producing similar rates of function words (e.g., pronouns, prepositions, and conjunctions) in their dialogue (Gonzales et al., 2010). Moreover, Pennebaker (2011) argues that higher LSM does not necessarily suggest agreement in terms of the content of the material being discussed; rather, it suggests that two people in a dyad automatically mirror or repeat back specific words and phrases (Babcock et al., 2014). Emphasizing function words rather than content words allows research to assess dyadic linguistic coordination irrespective of context (Ireland et al., 2011).

Linguistically, function words help keep track of the mutual knowledge shared between speakers so that each person understands what the other is referencing (Cannava & Bodie, 2017). Function words are short (typically 1–4 letters) and occur at extremely high frequencies in most day-to-day conversations, accounting for 60% of words that are spoken (Gonzales et al., 2010; Ireland & Pennebaker, 2010). Function words are processed in people's brains faster than content words such as nouns and verbs (Diaz & McCarthy, 2009), are predictable and help to achieve communication goals, but are largely undetectable by both speakers and trained observers (Niederhoffer & Pennebaker, 2002). The similarity in function word usage between people is thought to be a primarily unconscious coordination process (Ireland & Pennebaker, 2010). Notably, this is not a reference to the meaning of *unconscious* as it is used in the psychoanalytic literature (i.e., repressed material often related to primitive drives/instincts in the client's mental life) but instead refers to the meaning of *unconscious* as it is used in the context of language use (i.e., automatic, less-controlled communication behaviors).

Conceptually, as described by Müller-Frommeyer, Frommeyer, and Kauffeld (2019a), LSM has many theoretical foundations, ranging from interpersonal coordination theories (e.g., Lumsden, Miles, Richardson, Smith, & Macrae, 2012), to communication accommodation theory (Shephard, Giles, & LePoire, 2001) and interactive alignment (Muir, Joinson, Cotterill, & Dewdney, 2016). These theories share conceptual basics, especially the belief that automatic linguistic coordination represents interpersonal synergy (Riley, Richardson, Shockley, & Ramenzoni, 2011) and may thus be a proxy of an implicit aspect of the therapeutic alliance. More specifically, the level of LSM is thought to map directly onto the interpersonal coordination of psychological states (Ireland & Pennebaker, 2010) and may be considered an implicit aspect of Rog-

ers' (1957) therapeutic relationship quality of congruence, important for engaging in genuine contact.

Overview of Current Implementations of LSM

LSM in Psychology

LSM was introduced in studies in the era of social psychology (Niederhoffer & Pennebaker, 2002) and was applied to speed dating and relationship maintenance (Ireland et al., 2011), predicting the degree of mutual romantic interest in speed dating partners, successful conflict resolution between romantic partners (e.g., Bowen, Winczewski, & Collins, 2017), relationship stability in dating couples, as well as group cohesiveness in face-to-face communication environments (e.g., Ireland et al., 2011). There is consistent evidence that LSM increases as two people interact over time. Even in relatively brief interactions, LSM is predictive of relationship outcomes (Ireland et al., 2011).

Although most empirical studies on LSM support the idea that linguistic coordination yields positive outcomes (e.g., relationship initiation and stability; Ireland et al., 2011), other studies provide evidence that LSM is context-sensitive (Bowen et al., 2017). Within romantic partners, LSM does not uniformly signal interpersonal rapport (i.e., alliance bond) but instead aids communication by amplifying the positive or negative tone of an interaction (Bowen et al., 2017). Similarly, Babcock et al. (2014) found that LSM was highest in conversations when members talked about other people (using third-person pronouns) and were more disinclined to talk to each other. Moreover, studies have shown that linguistic coordination is context-sensitive, adaptive, and not always linked to positive outcomes (e.g., Fusaroli et al., 2012). Building on these empirical findings of linguistic behavior, Fusaroli, Rączaszek-Leonardi, and Tylén (2014) outlined a dynamic framework for studying dialog based on the notion of interpersonal synergy, and suggested that speakers develop linguistic patterns of stable interactions to fit the direct goals of the situation (i.e., good rapport, solution of a problem) through context-sensitive alignment and complementary dynamics. In other words, people take turns in speaking, contribute to each others' perspectives, and develop routines to effectively structure the interaction. Considering this more nuanced context-sensitive perspective, the successful coordination of function words likely reflects a common understanding of the conversational topic and a shared social knowledge (Meyer & Bock, 1999). Therefore, in this article, LSM is conceptualized as *interpersonal synergy*; an implicit linguistic coordination aimed at achieving a common goal.

LSM in Psychotherapy

Although LSM has often been researched in the context of everyday conversations (established benchmarks for low and high LSM are .60 and .85, respectively; Cannava & Bodie, 2017), little is known about the levels of LSM in psychotherapy. To date, two initial studies applied LSM to the psychotherapy context. First, Lord, Sheng, Imel, Baer, and Atkins (2015) examined LSM in individual psychotherapy training sessions. They analyzed 122 transcripts of 20-min motivational interviewing training sessions with standardized clients who portrayed a recently referred client with a substance use problem. Lord and colleagues found that

training sessions in which the therapists were rated as high in empathy showed higher levels of overall LSM ($M = .52$) than those that were rated as low in empathy ($M = .42$). Second, Borelli et al. (2019) examined the trajectory of LSM across a 12-session manualized psychodynamic therapy for seven substance-dependent mothers. They measured overall LSM in four of the 12 sessions and reported an average LSM of .89 ($SD = .02$), which remained consistent throughout the early and middle sessions, and decreased from Session 9 to Session 11 ($M = .88$, $SD = .02$). Further, lower early LSM in these therapist–client dyads predicted greater posttreatment psychiatric distress. After controlling for clients' pretreatment psychiatric distress and therapist, LSM mediated the association between clients' pretreatment relational problems and posttreatment psychiatric distress. These two preliminary applications of LSM suggest that more empathetic therapists might match their language style to their clients to a larger extent, and that LSM might reflect a relationship quality in psychotherapy, which is important for posttreatment symptom reduction.

Practical Guidelines in the Application of LSM in Psychotherapy

To complement these two preliminary studies that applied LSM to single training sessions (Lord et al., 2015) and brief 12-session manualized treatments (Borelli et al., 2019), this article provides two empirical examples of the application of LSM in long-term psychoanalytic treatments. First, LSM is applied to a psychoanalytic treatment sample of 140 sessions of seven long-term treatments. Then, its clinical usefulness is reported in a case study in relation to alliance and outcome measurements.

LSM at Session Level

Following the editing process, client and therapist texts for each session were examined with the LIWC software (Pennebaker, Booth, & Francis, 2007). The LIWC2015 software and the LIWC2015 Operator's Manual are published by Pennebaker Conglomerates, Inc., Austin, Texas. The software comes with a single application file for either Windows or Macintosh, and an unlimited academic license for this program costs $89.95 (see website http://liwc.wpengine.com/). The software calculates a percentage of total words in a text that fall into 70 different, nonexclusive word categories, including nine function-word categories that are used in the calculation of the LSM metric (Niederhoffer & Pennebaker, 2002): auxiliary verbs (e.g., might, would), articles (e.g., the, a, an), common adverbs (e.g., always, naturally), personal pronouns (e.g., I, his, their, you), indefinite impersonal pronouns (e.g., another, someone), prepositions and relative pronouns (e.g., of, which, in), negations (e.g., no, not, never), conjunctions (e.g., and, but, because), and quantifiers (e.g., much, few). After separating the transcripts by speaker, the percentage of function words (i.e., relative score, controlling for differences in the number of words used by each speaker) is calculated for each of the nine function word categories and each therapist and client.

To reach the overall LSM score for each session and each client-therapist dyad, first the absolute value of the difference between proportions for a client and a therapist for each function word category is calculated (|(Function Word Client – Function

Word Therapist)|). This value is then divided by the combined function word category proportion for the dyad (Function Word Client + Function Word Therapist + .0001). In the denominator the .0001 is added to prevent empty data sets. This score is standardized by taking the absolute value and subtracting it from 1, yielding a range of 0 to 1, per the following equation:

$$LSM_{FW} = 1 - \frac{|FW_{Client} - FW_{Therapist}|}{FW_{Client} + FW_{Therapist} + 0.0001} \tag{1}$$

This calculation is repeated for each of the nine function word categories for each dyad at each of the therapy sessions. The nine category-level LSM scores are then averaged to yield a composite LSM score bounded by 0 and 1, where higher numbers represent greater LSM between client and therapist.

LSM at the Level of Speaking-Turns

The overall LSM metric describe above is fundamentally a dyadic index at the overall conversational level (Cannava, 2018). However, in psychotherapy, there is a temporal sequence of many conversational turns within a single session. To assess the temporal reciprocity in LSM, a reciprocal LSM metric has now been developed (rLSM; Müller-Frommeyer et al., 2019a). Different from the overall LSM metric that captures similarity in the use of function words per session, the reciprocal LSM metric captures the accommodation of function words unfolding over adjacent speaking-turns of a conversation (Müller-Frommeyer et al., 2019a). Although no empirical studies on reciprocal LSM have been published yet,[1] both overall LSM and reciprocal LSM metrics are based on the same conceptual underpinnings. The calculation of reciprocal LSM is also based on Equation 1, but applied to each pair of successive speaking-turns throughout a session. As a result, one reciprocal LSM score is obtained for each pair of successive speaking-turns in the session. These scores represent the time-series of reciprocal LSM within a session. Additionally, scores can be assigned to individual speakers, thereby deriving a time-series for the therapist and a time-series for the client, representing how much the therapist matched the client and vice versa. Reciprocal LSM calculations are performed using the Rscript provided by Müller-Frommeyer, Frommeyer, and Kauffeld (2019b), which can be retrieved from https://osf.io/arxgu/. The example in Table 1 is an excerpt from a hypothetical psychotherapy transcript that illustrates the use of function words by the therapist (T) and the client (C) as well as their respective levels of reciprocal LSM.

A Treatment Sample

The levels of overall and reciprocal LSM were calculated for a subsample of seven 20-session treatments from the Psychoanalytic Research Consortium. Per treatment, 20 transcribed sessions were available, reflecting eight early sessions (first year of treatment), four mid sessions (third year of treatment), and eight late-phase sessions (fifth year of treatment). This resulted in a total of 140 examined sessions. The three treatment phases illustrate the change over time and their relation to long-term treatment outcome. The seven treatments were conducted by five American male psychoanalysts. Three clients were women. The treatments averaged 3.6 sessions per week, and the average duration was 653 sessions.

The overall goals were twofold: First, to examine the degree to which psychoanalytic treatments foster interpersonal synergy, according to the level of LSM, as this is manifest within and between sessions in the early, middle, and late phase of treatment. Second, to assess whether and how the level of overall and reciprocal LSM predicts treatment outcomes. Given the uniquely intimate nature of the therapeutic relationship, LSM levels were expected to be in a similar range as the previously published LSM levels of sessions of psychotherapy (training), and interactions between romantic partners and friends (H1). Considering the expected alliance fluctuations between and within sessions indicated by theories of change (e.g., cyclical nature of the therapeutic discourse; McCarthy, Mergenthaler, Schneider, & Grenyer, 2011) and recent empirical studies (Eubanks, Muran, & Safran, 2018), it was hypothesized that overall LSM and reciprocal LSM would show a nonlinear pattern over time (H2). Moreover, because therapists try to build alliance by matching the client, it was expected that therapists adapt more to their clients than vice versa. Reciprocal LSM dynamics of speaking-turns were thus expected to show that therapist's language style would follow the client's language style (H3). Based on the alliance-psychotherapy outcome literature, both LSM metrics were expected to be negatively related with symptom severity (H4), and both LSM metrics at early phase were expected to be positively related to symptom reduction, and improved global functioning (H5).

Preparations

For this subsample of 140 sessions, confidentialized transcripts were already available. To calculate function word usage within the therapeutic dyad, transcripts of therapy sessions were segmented by speaker, separating therapist utterances from client utterances into separate documents. Then, the two text files of each verbatim transcript per session were manually edited according to the guidelines put forth by Pennebaker and colleagues in the Linguistic Inquiry and Word Count (LIWC) coding Manual (Pennebaker, Booth, et al., 2015; Pennebaker, Boyd, Jordan, & Blackburn, 2015; see Supplemental Material A in the online supplemental materials). For example, filler words (e.g., "like") and nonfluencies (e.g., "um") are marked so that they would be treated as fillers rather than as content words. The transcript editing of the 140 transcripts took a total of 210 hr (1.5 hr per 45-min session) and was split between two research assistants, who spent seven hours per week on transcript editing for the duration of the semester (15 weeks).

LSM Data Analyses

The distribution of overall and reciprocal LSM data was explored in SPSS. The use of an existing dataset and computerized codings meant that there were no missing data. Because of the exploratory nature of this pilot study of seven treatments, the

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[1] Müller-Frommeyer et al. (2019a) describe a median reciprocal LSM score of .2 and median overall LSM score of .8 for speech turns between Romeo and Benvolio, taken from William Shakespeare's (1597) tragedy *Romeo and Juliet*. They suggest that the current benchmarks for low (LSM = .60) and high (LSM = .85) LSM (Cannava & Bodie, 2017) are not adequate when using the reciprocal LSM metric.

Table 1

Illustration of Function Word Use and Reciprocal LSM Calculations in an Excerpt of a Client–Therapist Interaction

Speaker	Statement	Function words (%)	rLSM
T	*How is it* going?	75	
C	*Well,* kind of *a* mess.	50	.80
T	Kind of *a* mess, alright, *so let us* check *in with that.*	64	.88
C	*Well, something* happened.	67	.98
T	*What* happened?	50	.86
C	*I was in a* relationship *that* ended *on* Friday.	67	.86
T	Ah, *I am so* sorry ah, ok.	43	.78
C	*I was like in a* major depressed. . ., got *off* work Monday, *and I could not* get *out of* bed, *and have not* eaten *in* three days *and* lost weight, *you* know, slowly getting better *but but it is still in a* bad place.	58	.85
M rLSM			.86

Note. LSM = language style matching; rLSM = reciprocal LSM. Function words are written in italics. Calculations across speaking-turns in this example are based on the rLSM metric by Müller-Frommeyer et al. (2019a). The *M* rLSM score reflects the mean of the reported reciprocal LSM calculations.

reported LSM analyses are provided as a simple demonstrative illustration of the application of the method and will need further replication in larger scale research studies.

To address the first, second, and third research question on the levels of LSM and LSM change over the course of therapy, rLSM was calculated per client and therapist speaking-turn, and overall LSM was calculated per session and during early, mid, and late sessions. The speaking-turns were averaged per session, and sessions were averaged per treatment phase and over treatment. Reciprocal LSM analyses were based on ore than 14,000 observations of speaking-turns in 140 sessions within the seven treatments. A linear mixed-effect model was applied to indicate temporal sequences within and between sessions as well as dynamics between therapist and client over time. Prior to analysis, equally sized means were created for early, middle, and late rLSM within each session. To do so, the overall amount of speaking-turns was divided by three and the mean of the first six speaking-turns in each phase was calculated. Linear mixed-effects models were used to analyze the effect of time (early, middle, and late within and between sessions) on rLSM, addressing the nesting of speaking-turns, within sessions, within treatments. For the within-session analyses, session and treatment were included as random effects. For the between-session analyses, treatment was included as random effect. First a linear model and then a quadratic model was tested. Maximum random effect structure was used (Barr, 2013). The analysis was performed in R (R Development Core Team, 2016), using the lme4 library (Bates, Maechler, Bolker, & Walker, 2015).

The fourth and fifth research question (whether and how the level or change of LSM relates to psychopathology and treatment outcome) were examined by correlating overall and reciprocal LSM with early treatment symptom levels and treatment change. Outcome measures were (a) Global Assessment of Functioning (GAF; Axis V of the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision [*DSM–IV–TR*]; American Psychiatric Association, 2000), a measure of a client's overall functioning designed to track clinical progress, and (b) Personality Health Index (PHI; Waldron et al., 2011), a measure of a client's psychological health-sickness, based upon a normative sample of clients in psychoanalysis, derived from the Shedler-Westen Assessment Procedure (SWAP-200; Shedler & Westen, 1998, 2007).

Both outcome measures were rated by trained observers on eight early sessions at the beginning of treatment (year 1) and on eight late sessions at the end of treatment (year 5). Change scores between the early and late rating of both PHI and GAF scales were calculated. Six clients showed significant improvement on the PHI and four of the seven clients showed significant improvement on the GAF, measured at the early (eight sessions year one) and late phase (eight sessions year 5) in treatment.

Findings Between Sessions

Word count for the clients in the seven treatments ranged from 449 to 11,767 per session ($M = 4,255$, $SD = 1,444$), and word count for the therapists ranged from 30 to 7,290 per session ($M = 1,096$, $SD = 1,070$). The LSM data for the 140 sessions were not normally distributed, so nonparametric tests were used. In line with the LSM metric based on relative use of function words (% of total word count per speaker), LSM per session was significantly related to client word count ($r_s[140] = .33$, $p < .001$) and therapist word count ($r_s[140] = .41$, $p < .001$), with more verbal speech of each speaker showing higher similarity of language style, but not related to overall session word count ($r_s[140] = -.09$, $p = .86$).

The mean overall LSM for the treatment across the sample was $M = .84$ ($SD = .07$) and ranged from .51 to .91. This range was just outside the provided low and high overall LSM benchmarks (.60 and .85, respectively) and similar to the published data on overall LSM[2] (e.g., .51 for instant messaging and .90 for conversations among romantic partners) and comparable with values reported in the previous psychotherapy samples (Borelli et al., 2019; Lord et al., 2015). Throughout the treatments, the level of overall LSM per session appeared to remain stable, from early phase ($M = .84$; $SD = .04$; range = .79–.90), mid phase ($M = .84$; $SD = .06$, range = .76–.91), to late phase ($M = .84$; $SD = .04$, range = .78–.90). The overall LSM session-by-session scores for the eight early phase, four midphase, and eight late-phase indicated

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[2] Published data on LSM show that average scores in nontherapeutic settings range from .51 ($SD = .05$) for instant messaging chatting, .90 ($SD = .07$) for written correspondence, .70 ($SD = .10$) for poetry, .90 ($SD = .07$) for spoken conversations among romantic partners, and .72 ($SD = .07$) for online writing assignments.

different pathways of change for the seven clients. See Figure 1 for a graph with individual trajectories of overall LSM per session for each of the seven clients over time.

Findings Within Sessions

The within-session variability and temporal dynamics of LSM per speaking-turn were examined with the reciprocal LSM metric. The mean reciprocal LSM across the sample was $M = .48$ ($SD = .05$) and ranged from .38 to .54. The rLSM data were not normally distributed (skewness and kurtosis more than twice the standard error).

For within-session trajectories of change in the treatment sample, first a linear model was tested then a quadratic model was tested. No linear trends ($B = -.004$, $SE = .008$, $t = -0.50$, $p = .62$) or quadratic trends ($B = -.2355$, $SE = 2.032$, $t = -.012$, $p = .99$) within session were identified. For the between-session trajectories, first a linear model was tested ($B = -.016$, $SE = .006$, $t = -2.75$, $p < .05$), then a quadratic model was tested ($B = -.004$, $SE = .002$, $t = -2.44$, $p = .05$), indicating that the trajectories of time between sessions followed a negative (high–low) linear pattern over time.

Examining the individual reciprocal LSM trajectories for the seven clients in the treatment sample, results showed that the therapists' level of rLSM were significantly lower than the clients' level of rLSM within sessions ($B = -.004$, $SE = .004$, $t = -9.73$, $p < .001$), as well as between sessions ($B = -.109$, $SE = .023$, $t = -4.60$, $p < .01$). This suggests that clients followed their therapist's language style. Figure 2 illustrates the trajectory of reciprocal LSM within an early, mid and late phase session from a case from the treatment sample.

Findings in Relation to Symptoms

Early LSM appeared to be positively associated with change on the PHI ($r_s[7] = .86$) and on the GAF ($r_s[7] = .83$), but not with early treatment functioning (PHI $r_s[7] = -.34$; GAF $r_s[7] = -.71$). Overall treatment LSM was not related to healthy functioning early in treatment (PHI $r_s[7] = -.29$) or PHI change over treatment ($r_s[7] = .68$), and appeared to be negatively associated with GAF early in treatment ($r_s[7] = -.86$) and positively associated with GAF change ($r_s[7] = .78$). In contrast to our hypothesis, this would indicate higher levels of function word similarity in dyads with clients with lower global functioning, and those who show more improvement over treatment.

Mean reciprocal LSM early in treatment did not appear to be correlated with client functioning on the GAF ($r_s[7] = -.04$) but negatively related with healthy functioning on the PHI ($r_s[7] = -.67$) early in treatment. Reciprocal LSM early in treatment appeared to be unrelated to change in functioning (GAF $r_s[7] = -.02$; PHI $r_s[7] = .21$). Different from the overall LSM findings, mean reciprocal LSM over treatment also did not appear to be related to client functioning early in treatment (PHI $r_s[7] = -.40$; GAF $r_s[7] = .50$) or change on the PHI ($r_s[7] = -.29$) or the GAF ($r_s[7] = -.56$). For a visual inspection of the correlations scatterplots are provided in Supplemental Material B in the online supplemental materials.

In sum, in this treatment sample, early overall LSM appeared to be positively related to change in client functioning over treatment (on the PHI and GAF). Overall treatment levels of LSM appeared to be negatively related to levels of functioning on the GAF in these same early sessions but positively related to change in GAF. Notably, given the very small treatment sample ($N = 7$ clients), indications of associations between variables are only exploratory in nature and need to be replicated in statistical analyses of larger samples before they can be interpreted with confidence.

A Demonstration of the Clinical Usefulness of LSM

Case Study

To demonstrate the clinical usefulness of the LSM approach in psychotherapy, the psychoanalytic treatment of Mr. A will be
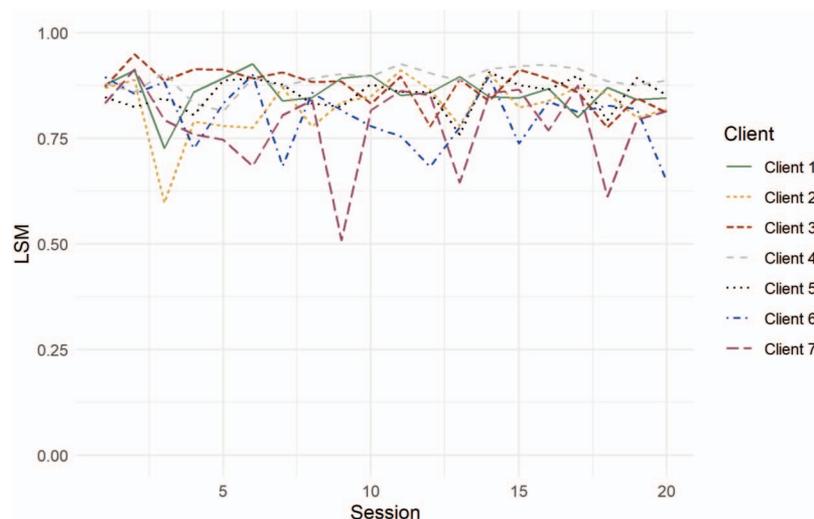

Figure 1. Individual trajectories of language style matching (LSM) per session for each of the seven clients over time. See the online article for the color version of this figure.
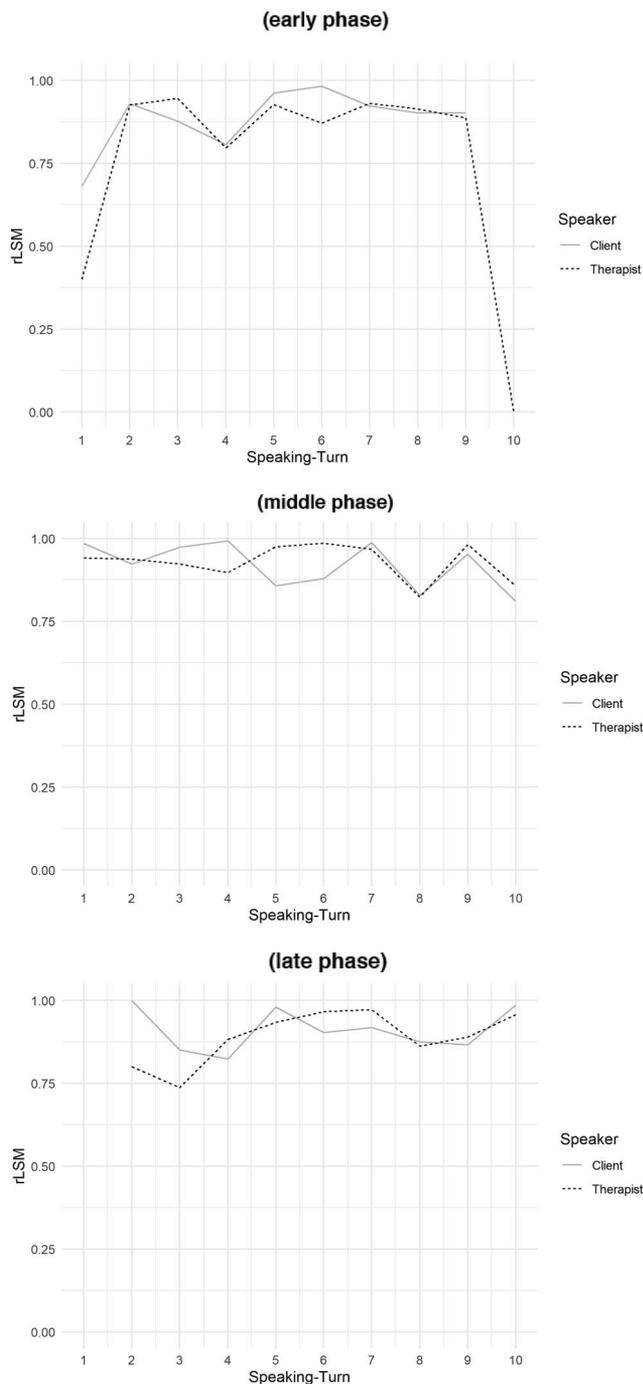
Figure 2. Trajectories of reciprocal language style matching (LSM) in the first 10 speaking-turns from a session in the early-phase, middle-phase and late-phase of a treatment. rLSM = reciprocal LSM.

reported (see Porcerelli, Dauphin, Ablon, Leitman, & Bambery, 2007). In this 5-year treatment of a 50-year-old male (Mr. A) diagnosed with an avoidant personality disorder (AVPD), different aspects of the therapeutic alliance (observer-rated working alliance by way of agreement of task, goals, and bond and computerized assessment of LSM) were triangulated, in relation to treatment outcome. In addition to meeting criteria for AVPD, Mr. A reported significant psychological distress, object relations pathology, and moderately severe interpersonal impairment at intake. At the outcome of treatment and at 1-year follow-up, Mr. A reported clinically significant improvements in personality functioning, symptom severity, and interpersonal functioning. Gains were maintained at 1-year follow-up (Porcerelli et al., 2007). Fifteen transcribed audio-recorded sessions (three at the end of each of five treatment years) were available.

This examination of the transcripts of the 15 recorded sessions provides the first systematic case study of interpersonal synergy over the course of a long-term psychoanalytic treatment of AVPD. To assess the construct validity of LSM, the relationship between overall LSM per session was also examined with the corresponding observer-rated alliance scores on the Working Alliance Inventory (WAI). Two independent raters completed the WAI-Observer scale (WAI-O; Tichenor & Hill, 1989) for each of the 15 available sessions. Then, change in overall LSM and WAI-O was examined over the five treatment years, analyzing three sessions per year (total of 15 sessions). Average scores of the raters were used in further analyses.

As hypothesized for the treatment sample described earlier, the LSM levels in this case study were expected to be in a similar range as previously published LSM levels (H1). A nonlinear sequence of reciprocal LSM was expected within sessions, with a similar pattern of overall LSM throughout treatment over time (H2). Moreover, it was expected that the therapist's language style would follow Mr A's language style (H3). This case study did not allow for examination of the relationship between LSM and psychopathology (H4) or treatment outcome (H5). Given the conceptual convergence of LSM with aspects of the alliance, especially WAI-O goals as proxy of interpersonal synergy, it was hypothesized that the trajectory of change in LSM would be positively related to observer-rated measurements of alliance (WAI-O) for goals, task, and bond (H6).

Findings Between Sessions

As to be expected in psychoanalytic treatment, the client contributed more to the conversations than the therapist. Word count for Mr. A ranged from 1,655 to 3,063 per session ($M = 2,672$, $SD = 376$), whereas the word count for the therapist ranged from 74 to 414 per session ($M = 185$, $SD = 98$). The overall LSM data were normally distributed (skewness & kurtosis less than twice the standard error). The average overall LSM for Mr. A and his therapist throughout the 15 examined sessions was .80 ($SD = .06$), ranging from the lowest score of .69 (Session 7, year 3) to the highest score of .89 (Session 8, year 3 and Session 13, year 5). This is in line with previous publications using this overall LSM metric.

Changes in mean WAI-O and overall LSM scores over the five years of treatment (see Figure 3 and 4 for mean WAI-O and overall LSM scores per year) indicate that, unlike the working alliance, which remained relatively stable over time, the level of interpersonal synergy was highest in the first year of treatment (overall LSM = .84). In this first year of treatment Mr. A also showed the highest levels of symptom severity and resistance. When Mr. A started to show an improvement in symptoms and general func-
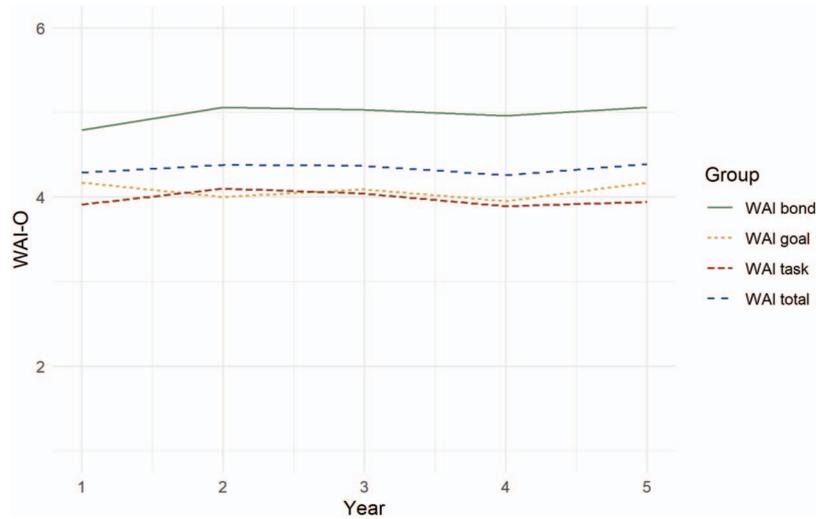
Figure 3. Mean levels of Working Alliance Inventory-Observer (WAI-O) per year of treatment. See the online article for the color version of this figure.

tioning (after the first year), the levels of interpersonal synergy reduced.

Looking at the sessions individually (see Figure 5 for overall LSM scores for the 15 sessions, in the five treatment years), the overall LSM levels changed substantially between sessions, ranging from an increase of .20 between Session 7 and 8 and a decrease of .12 between Session 8 and 9. This suggests that there was a lot of variability in overall LSM within the third treatment year, something that did not become apparent when analyzing mean LSM scores per year. It is notable that in Session 7 and 8 change was particularly large for LSM (from .69 to .89; lowest to highest in treatment) and the WAI bond (5.25 to 4.67; highest to lowest in treatment). At this point in the treatment, the topic of the session became more intense, focusing on Mr. A's aggressive impulses and avoidance of his wife instead of his driving phobia. Addition-

ally, the therapist was more inquisitive and directly challenged Mr. A's avoidance behaviors. In other words, the initial supportive tracking of Mr A.'s experience (i.e., building alliance) was replaced by more challenging explicit defense interpretations.

Findings Within Sessions

The mean reciprocal LSM across the 15 sessions was $M = .51$ ($SD = .05$) and ranged from .41 to .61. There was an average of 22.7 ($SD = 8.81$) speaking turns per session. The rLSM data were not normally distributed (skewness and kurtosis more than twice the standard error). For within-session trajectories of change in the case study, session and year were included as random effects. For the between session analysis, year was included as random effect. First a linear model was tested ($B = .037$, $SE = .028$, $t = 1.309$,
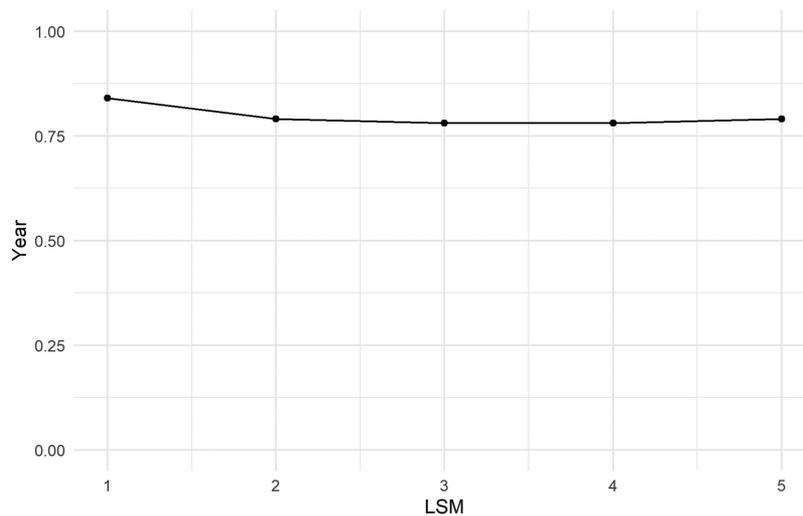

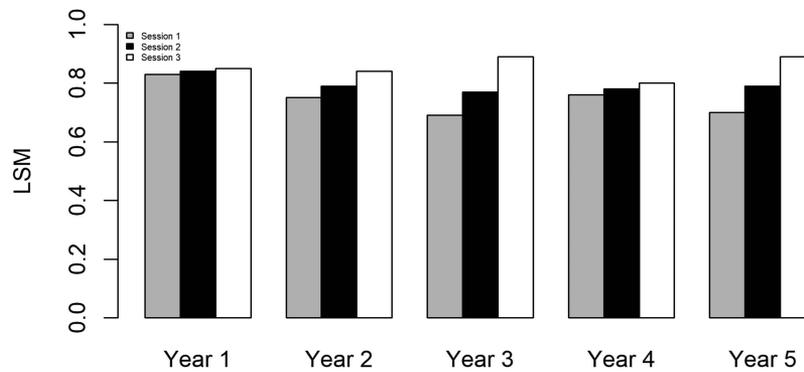*Figure 4.* Overall language style matching (LSM) scores.

Figure 5. Language style matching (LSM) per session per treatment year.

$p = .26$), then a quadratic model was tested ($B = .007$, $SE = .007$, $t = .98$, $p = .37$). For the between-session trajectories, first a linear model was tested ($B = .003$, $SE = .018$, $t = .17$, $p = .88$), then a quadratic model was tested ($B = .0001$, $SE = .005$, $t = .02$, $p = .98$). No linear or quadratic trends were identified in the data within and between session.

To test the hypothesis that the therapist adapts to the client's language style, the variability of LSM was calculated at the level of speaking-turns using the rLSM metric. For the case study, the therapist's level of rLSM was significantly lower than the client's level of rLSM within sessions ($B = -.169$, $SE = .025$, $t = -6.84$, $p < .001$), as well as between sessions ($B = -.18$, $SE = .022$, $t = -8.51$, $p < .001$). Thus, as was found in the treatment sample, the client appears to adapt to the therapist within sessions and over treatment. This temporal dynamic might imply that the therapist impacts what the client says throughout the conversation. Even though in these psychoanalytic psychotherapy sessions the therapist only utters very few words, the way in which the therapist speaks seems to highly influence the client's response. It is possible that the therapist, even in a few words, leads the client's response, and thus takes charge of the process in the session in an implicit way. In line with the findings by Danescu-Niculescu-Mizil et al. (2012), clients (with a lower perceived social status) appear to modify their word choice to match their therapist (perceived as having a higher status). Moreover, compared with therapists, clients tend to have a higher level of symptoms/psychopathology and lower self-esteem, and therefore might more easily adapt to the therapist. In contrast to Bucci and Maskit (2007)'s theory of mutual adaptation, likened to dancing the tango, it appears that in psychoanalytic interactions it is clear who is leading whom, at least with regard to language style.

Findings in Relation to Alliance

The overall LSM data and the WAI data met the assumption of independent errors. The scatterplot of standardized predicted values (i.e., standardized residuals) showed that the LSM and WAI data met the assumptions of homogeneity of variance and linearity. Tests to see whether the data met the assumption of collinearity indicated that multicollinearity was not a concern (Time and LSM, Tolerance = .92, variance inflation factor = 1.08). It is acknowledged that the following statistical analyses of overall LSM and alliance are based on this sample size of 15 sessions throughout five treatment years and thus only offer an illustration of the potential of the LSM method. Further replication in larger scale research studies is required before conclusions can be drawn.

When holding time constant, LSM was positively correlated to the WAI-O Goal subscale, $r = .36$, $p = .21$, reaching a moderate effect size, albeit not significant. LSM was unrelated to the WAI-O Task subscale, $r = .01$, $p = .97$. Contrary to the hypothesis, LSM was negatively correlated to the WAI-O Bond subscale, $r = -.54$, $p < .05$, reaching a large effect size. Reciprocal LSM, controlled for time, was also negatively correlated to the WAI-O Bond subscale, $r = -.61$, $p < .05$, reaching a large effect size, but not related to the other subscales (all ps $> .06$). See Supplemental Material B in the online supplemental materials for scatterplots of all correlations.

These preliminary indications of a positive relationship between overall LSM and WAI-O Goal combined with the negative relationship between overall and reciprocal LSM with WAI-O Bond may suggest that clients with AVPD are more comfortable with working toward agreed-on goals in psychoanalysis than they are acknowledging a deepening of the relationship (bond) with the therapist. In other words, the WAI-O Task and goal subscale may tap into efforts by therapist and client to agree, showing a positive correlation with LSM, whereas WAI-O Bond might reflect the relative ease and comfort of the session experience, which is negatively related to the hard work and effort of reaching interpersonal synergy. Thus, different from short interventions where, arguably, alliance building is more explicitly focused on making the client feel happy and comfortable, in long-term psychoanalytic treatments LSM might reflect the initial building of tolerance, before more challenging interpretations and relationship dynamics are worked through.

Possibly, clients with AVPD long for closeness with others but are more comfortable with relating to others in fantasy, because real relationships can be extremely anxiety-provoking for them. It is also possible that in psychoanalysis, a positive correlation between LSM and self-reported working alliance reflects the therapist's automatic efforts to lessen the client's fear/resistance, whereas a negative correlation between LSM and self-reported alliance bond reflects less fear/resistance on the client's part and thus less need for the therapist to provide a sense of safety and similarity. In other words, when a client appears comfortable/high functioning (reflected by a high working alliance-bond), the ther-

apist might be able to offer more challenging interpretations and create a therapeutic dissonance to stimulate change (reflected by lower LSM). Building on the reported case study, future research with larger samples may help to clarify the role of interpersonal synergy as a possible implicit aspect of the alliance during long-term treatment. This case study underscores the need to study multiple domains of client–therapist relating to understand the complexity of change processes and suggests that LSM may tap into a relationship component, not previously captured by ratings on traditional observer-rated measures of working alliance.

Taken together, these two exploratory examples illustrate how interpersonal synergy, according to the level of LSM, may manifest within and between sessions over long-term psychoanalytic treatments and in relation to alliance and treatment outcome. More specifically, the preliminary findings may be summarized as follows:

1. The LSM levels appeared to be in similar range as the previously published LSM levels of sessions of psychotherapy (training) and interactions between romantic partners and friends (H1).

2. Overall, LSM per session and reciprocal LSM within sessions appeared to remain relatively constant with no linear or quadratic pattern over time, although trajectories among the different therapist–client dyads varied widely. Throughout long-term treatments, a linear high–low sequence of reciprocal LSM indicated that LSM within sessions might reduce over time (H2).

3. The temporal dynamic between therapist and client in these preliminary session data indicated that client's language style followed the therapist's language style, implying that clients may adapt to their therapist within sessions as well as over treatment (H3).

4. In the treatment sample, LSM seemed to be positively related to symptom severity early in treatment (H4).

5. In the treatment sample, early phase overall LSM per session appeared to be positively related to symptom reduction and improved global functioning. Reciprocal LSM was unrelated to psychopathology and treatment outcome (H5).

6. In the case study, overall and reciprocal LSM appeared to be negatively related to self-reported alliance bond (H6).

Wider Applicability and Common Pitfalls

Applicability of LSM in the Field of Counseling

In line with Borelli et al. (2019), LSM appears to hold promise as a metric of interpersonal synergy, an implicit aspect of the therapeutic alliance. The LSM metric has potential for research and clinical applications. First, the practical advantages of computerized quantitative speech analysis of function words, including its reliability, objectivity, and cost-effectiveness (Tausczik & Pennebaker, 2010), might make it a promising tool for counseling and psychotherapy research. Automated text analysis programs such as

LIWC may potentially provide a means of analyzing dyadic dynamics when self-report data cannot be collected. For example, it could be applied as post hoc process analysis on a previously collected sample of therapy transcripts. This means that existing psychotherapy data sets may be analyzed retrospectively, allowing for testing of the LSM construct validity relatively easily.

Second, LSM may be a useful complement to self-report data. The overall and reciprocal LSM metrics may provide a novel way to study some of the more elusive aspects of the therapeutic alliance and the therapeutic process, not captured by self-report measures of attunement, alliance, or empathy or physiological measures of body movements. LSM is unlikely to be influenced consciously and may be too subtle to be perceived by coders; it thus allows examination beyond the verbal content of the interaction to the content-free functional verbal interaction. Nonverbal synchrony has shown to facilitate the working alliance, which in turn promotes the client's emotion-regulatory skills (Koole & Tschacher, 2016). This means that the LSM metric could potentially be applied in conjunction with measures of affect experiencing in-session and help elucidate the role of implicit aspects of alliance in affect regulation and tolerance in psychotherapy (Håvås et al., 2015).

Third, LSM measurements may allow for useful comparisons between different treatment models. The LSM metrics rely on the ratio of function words relative to general word count per speaker, which means that different types of psychotherapies in which therapists tend to be more or less verbally active (e.g., psychoanalysis vs. CBT) might still result in similar levels of LSM. Once this pan-theoretical LSM metric is validated, it may help to translate intuitive processes that are familiar to psychoanalytic clinicians, into a measurable construct that can be communicated to counselors more broadly. In future, the reciprocal LSM metric could help identify trajectories of relational change over time (either within-session, session-by-session or from early, mid and late phase of treatment), illustrating how meaningful interaction is achieved by speakers on a turn-by-turn basis in different treatment models. LSM may be both predicted by prior relationship experiences and predictive of the quality of future interpersonal processes occurring between therapist and client. Given the consistent relationship between quality of alliance and treatment outcome, future research may explore whether LSM levels in early sessions prove to have significant prognostic value, potentially predicting the self-reported working alliance and eventual treatment outcome, and signaling cases that are unlikely to do well.

If the overall and reciprocal LSM metrics are validated in these research applications, a possible future clinical application lies in improving clinical training programs. Therapists vary substantially in clinical effectiveness, and at least some of these variations are attributable to their different abilities in forming a strong alliance (Del Re, Flückiger, Horvath, Symonds, & Wampold, 2012). Whether or not levels of function words are automatically coordinated, it is the therapists' responsibility to notice when they are matched to clients and when they are not. In the future, the LSM metrics might offer a medium in which to provide reliable feedback to counselors regarding their client's ability to match their language style. In this manner, LSM could help counselors to build and strengthen their clinical assessment expertise. The next step could then be to provide alliance trainings, in which tracking LSM is explicitly taught. It should be emphasized, however, that attuned

responses, especially the implicit ones, reflect essentially an intuitive, spontaneous, and immediate activity and are to a lesser degree driven by cognitive processes. It is thus reasonable to assume that this may limit the extent to which interpersonal synergy can be fully learned (Håvås et al., 2015).

Avoiding Common Pitfalls in Applying LSM and Interpreting the Findings

Several potential pitfalls were identified in applying LSM to psychotherapy treatments. As is the case with other text-analysis programs, computerized analysis with the LIWC program offers the option of datamining; exploring the relationships between all 70 possible word categories (different content words, themes and stylistic differences) to search for significant findings, not based on predetermined hypotheses (Rasmussen, Malchow-Møller, & Andersen, 2011). Also, the fact that one could potentially run the LIWC program with raw transcripts that are not edited, without an error message, makes it possible to generate invalid results and cut corners that might not be picked up by reviewers or collaborators.

Besides these potential practical pitfalls, there are several other important pitfalls that must be avoided when interpreting the LSM findings. First, the output and interpretation of high LSM scores might be somewhat misleading. If both people use the same percentage of function words, their level of matching is deemed 100%. This implies that a high LSM score can represent people not matching their language style; people can match by not matching. This could be a problem for how LSM is conceptualized, and LSM results are interpreted and how it functions to predict treatment outcomes (Müller-Frommeyer et al., 2019a).

A second potential pitfall in interpreting LSM findings is that it currently remains unclear how exactly LSM is related to the operationalized constructs of therapeutic alliance, synchrony and attunement. Snyder and Silberschatz (2017) conclude in their validity study that attunement may well be a more specific subcomponent of the therapeutic alliance. Thus, in line with this case study illustration, the next research step should be to test the construct validity of LSM in larger treatment samples. This would help to determine the degree of convergence between LSM and an established measure of the alliance such as the WAI and test whether the LSM metric predicts the alliance and subsequent treatment outcome. Similarly, future research on the WAI and LSM predicting outcome would allow for the testing of the incremental validity of LSM.

A third possible pitfall in interpreting the LSM results is drawing conclusions without having a benchmark for the overall and reciprocal LSM metrics in good and bad outcome treatments. Too few empirical studies have been conducted so far to be conclusive about the meaning of the LSM trajectories, within sessions, and over treatment, and the differences between treatments. Also, it is possible that LSM research that only includes a subsample of segments within sessions or a subsample of sessions within treatment does not validly represent the nonlinear process of interpersonal synergy in therapy. Mergenthaler (1996)'s Therapeutic Cycles Model, for example, suggests that gains accumulate throughout treatments and that linguistic change is nonlinear, occurring in one or more cycles per treatment (e.g., McCarthy et al., 2011). Moreover, the LSM metric does not currently address any cultural/class differences in use of function words, implied by

the fact that not all of the function word categories are available in the dictionaries of all languages.

Like many other new approaches, the application of LSM relies on knowledge from other disciplines, which has been imported into the field of counseling and psychotherapy research only recently. Therefore, little systematic work has been done on the unique issues that arise in the process of integrating LSM in the examination of the client–therapist dyad. It remains unclear to what extent the previous studies conducted in other social sciences offer a relevant benchmark for LSM in psychotherapy. The two published studies (Borelli et al., 2019; Lord et al., 2015), together with the two psychoanalytic pilot studies reported in this article, offer an initial key point of reference for future empirical investigation. Based on the initial data reported here, it can be concluded that the Ireland and Pennebaker (2010) overall LSM metric only captures a balanced use of function words between two conversational partners rather than dynamic coordination. Hence, in psychotherapy, where conversational dependency is assumed, the new reciprocal LSM metric is arguably most clinically relevant.

Remaining Questions and Directions for Future Research

The LSM metrics may create several unique opportunities in the future for the examination of therapist–client interactions, particularly those aspects which elude conscious awareness of the therapist, client, or outside observer, that nonetheless exert an influence on treatment outcome. First, in larger scale studies, therapist trait and state variables that may influence the level of implicit alliance, such as countertransference and attachment style (Mikulincer & Shaver, 2008), could be examined as moderating factors. Similarly, further research into specific strategies that might change the level of interpersonal synergy in sessions could be important.

Also, given the reported pilot data, clients' levels of function word use early in treatment might reflect their psychopathology. Interpersonal synergy is thus expected to be higher in the treatments of clients with more severe psychopathology. The appropriate separation from the therapist may then be reflected by lower LSM scores at the end of successful treatments. Perhaps clients who are more sensitive to interpersonal rejection (such as clients with personality disorders) might be more sensitive to momentary fluctuations in the therapist's language style, whereas those clients with more robust pretreatment psychological functioning might show less need for interpersonal synergy. The same could be true for therapists. Future large-scale research is needed in which the moderating effect of client psychopathology and therapist factors can be examined.

Moreover, the level or range of function words clients and therapists use might reflect their culture, educational level, and upbringing, more than the dynamic response to the current situation of the conversation. Therefore, researchers should also examine aspects of therapist—client fit (e.g., racial/ethnic/gender matching) in terms of their contribution to LSM. Also, future research is needed to examine how function word usage might differ in different types of discourse within psychotherapy, ranging from concrete language (e.g., symptom descriptions, early memories, dreams, and relationship episodes) to philosophical discourse (e.g., interpretations or insight). In line with expected

differences in alliance between treatment orientations and clients (Zilcha-Mano & Errázuriz, 2015), further larger-scale research is warranted that allows for comparisons of levels of LSM between treatments, therapists and clients. This will allow researchers to disentangle trait-like from state-like characteristics of interpersonal synergy.

Furthermore, in future research, it may be useful to adopt a construct validation framework (e.g., Cronbach & Meehl, 1955) for assessing the overall and reciprocal LSM metrics as a measure of alliance. LSM could, for example, be compared with other computerized programs of language style analysis, such as the Discourse Attributes Analysis Program (Bucci & Maskit, 2006). In addition to triangulation with verbal process measures, LSM analysis could be usefully complemented by nonverbal indicators of implicit relational behavior, including acoustic (Imel, Steyvers, & Atkins, 2015), vocal rhythm coordination (Håvås et al., 2015), movement synchrony (Ramseyer & Tschacher, 2011), and physiological measures of heartrate and skin conductance (Marci, Ham, Moran, & Orr, 2007). Using these approaches will increase methodological pluralism (e.g., Barber & Sharpless, 2009) and will help provide a more comprehensive description of the implicit therapeutic process.

In sum, the intention in this article was to describe and test the overall and reciprocal LSM metrics, conceptualized as a proxy of interpersonal synergy, for its potential use in counseling and psychotherapy research. A theoretical framework was provided in which to situate the potential utility of the LSM construct, and hypotheses were explored within a pilot treatment sample and a single case study of long-term psychoanalytic treatment. These two empirical examples illustrate how LSM could yield further insight into the extent to which and mechanisms by which implicit aspects of the alliance, different from observer-rated alliance-bond, predict treatment outcome. Future larger-scale research into the relationship between LSM, clients and therapists' variables, as well as LSM differences between treatments over time is warranted.

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