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Using Session-by-Session Measurement to Compare Mechanisms of Action for Acceptance and Commitment Therapy and Cognitive Therapy

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Debate continues about the extent to which postulated mechanisms of action of cognitive behavior therapies (CBT), including standard CBT (i.e., Beckian cognitive therapy [CT]) and acceptance and commitment therapy (ACT) are supported by mediational analyses. Moreover, the distinctiveness of CT and ACT has been called into question. One contributor to ongoing uncertainty in this arena is the lack of time-varying process data. In this study, 174 patients presenting to a university clinic with anxiety or depression who had been randomly assigned to receive either ACT or CT completed an assessment of theorized mediators and outcomes before each session. Hierarchical linear modeling of session-by-session data revealed that increased utilization of cognitive and affective *change* strategies relative to utilization of psychological *acceptance* strategies mediated outcome for CT, whereas for ACT the mediation effect was in the opposite direction. Decreases in self-reported dysfunctional thinking, cognitive "defusion" (the ability to see one's thoughts as mental events rather than necessarily as representations of reality), and willingness to engage in behavioral activity despite unpleasant thoughts or emotions were equivalent mediators across treatments. These results have potential implications for the theoretical arguments behind, and distinctiveness of, CT and ACT.

Keywords: ACT; CBT; psychotherapy mechanisms; mediation

Cognitive behavior therapy (CBT) is a broad model of psychotherapy that targets changes in the content and/or context of behaviors, thoughts, and feelings in the treatment of a variety of psychological disorders.

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When defined broadly (Forman & Herbert, 2009), CBT includes established models such as behavioral activation (BA; Jacobson, Martell, & Dimidjian, 2001; Jacobson et al., 1996) and Beckian cognitive therapy (CT; Beck, 1976, 1991), as well as newer "acceptance-based" behavior therapies including acceptance and commitment therapy (ACT; Hayes & Strosahl, 2005; Hayes, Strosahl, & Wilson, 1999), dialectical behavior therapy (DBT; Linehan, 1993), and mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2002; see Herbert & Forman, 2011, for a full consideration of acceptance and mindfulness approaches in CBT). Over the past decade, a series of studies have supported the efficacy of acceptance-based models of CBT, particularly ACT, with some indications of advantages of ACT over traditional forms of CBT (for reviews, see Hayes, Levin, Plumb, Boulanger, & Pistorello, in press; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Levin & Hayes, 2009). On the other hand, one moderately large randomized controlled trial (RCT) found that ACT and CT were equally effective for treating anxiety and depression (Forman, Herbert, Moitra, Yeomans, & Geller, 2007), and several recent reviews (Öst, 2008; Powers, Zum Vörde Sive Vörding, & Emmelkamp, 2009) have raised questions about the methodological rigor of studies evaluating ACT outcomes.

Much debate has also arisen as to whether ACT is meaningfully distinct from traditional models of CBT, such as CT (e.g., Arch & Craske, 2008; Hayes, 2008; Herbert & Forman, in press; Hofmann & Asmundson, 2008). Upon review, CT and ACT have striking similarities and differences in both their philosophical frameworks and intervention components (Forman & Herbert, 2009). For example, CT and ACT both stress the importance of learning processes in the development, maintenance, and treatment of psychopathology, and both CT and ACT make use of behavioral intervention techniques, such as psychoeducation, experiential learning, exposure, BA, problem solving, role playing, and modeling, among others. However, the two models differ in their underlying theories of psychopathology. CT theory attributes psychopathology to maladaptive cognitions resulting from systematically biased information processing (Beck, Rush, Shaw, & Emery, 1979). ACT theory attributes psychopathology primarily to psychological inflexibility caused by emotional avoidance, problematic attempts to control internal experiences, and fusion with thoughts and emotions (Hayes et al., 1999). Both CT and ACT allow for symptom reduction; however, only CT posits this as an explicit aim, whereas ACT prioritizes behaving consistently with one's chosen values. In terms of technology, CT helps patients identify, label, challenge, and restructure dysfunctional automatic thoughts, schemas, attributional styles, and core beliefs. ACT helps patients recognize that direct attempts to control internal experiences are problematic, and teaches skills to promote the acceptance of difficult experiences while simultaneously engaging in goal-directed behavior. ACT emphasizes increased awareness of present-moment experiences, clarification of core life values, and increased commitment toward value-consistent behavior. Although ACT emphasizes "cognitive defusion" (i.e., psychologically "stepping back" from one's thoughts and appreciating the fact that they are merely thoughts and not truths), it has been pointed out that CT engages the patient in a similar exercise implicitly if not explicitly through the process of cognitive disputation (Forman & Herbert, 2009).

In addition to issues of theory and technique, important questions exist about the extent to which mechanisms of action differ between the two treatments and how consistent such mechanisms are with each framework's respective theoretical foundation. That is, compared to ACT, is change in CT treatment more highly driven by movement from dysfunctional to more adaptive thinking, and less highly driven by acceptance of internal experiences (i.e., experiential acceptance), cognitive defusion, and willingness to engage in goal-directed behavior?

Most studies of CT have not investigated mediating mechanisms, but those that did have produced mixed results. Some studies (e.g., Casey, Newcombe, & Oei, 2005; Hofmann, 2004; Smits, Powers, Cho, & Telch, 2004; Smits, Rosenfield, McDonald, & Telch, 2006) have found evidence that changes in dysfunctional attitudes mediated outcome, whereas many other studies have not demonstrated such cognitive mediation (e.g., Burns & Spangler, 2001; DeRubeis et al., 1990; Longmore & Worrell, 2007; Teasdale, et al., 2001). In addition, there is little evidence indicating that even when postulated mediating mechanisms are detected they are differentially active for patients receiving different treatments, such as CT and pharmacotherapy (Longmore & Worrell, 2007). Relative to studies of CT, investigations of ACT have been both more likely to measure mediators and to obtain evidence for theorized mechanisms of action, in particular decreases in experiential avoidance (e.g., Bach & Hayes, 2002; Bond & Bunce, 2000; Gaudiano, Herbert, & Hayes, 2010; Gifford et al., 2004; Zettle, 2003; Zettle & Hayes, 1986; Zettle & Rains, 1989).

Especially rare have been studies that directly compare proposed mechanisms of CT and ACT.

Two studies comparing ACT's and CT's effectiveness in treating depression obtained results suggesting that defusion was a mediator only for ACT (Hayes, Masuda, Bissett, Luoma, & Guerrero, 2004; Zettle & Hayes, 1986; Zettle & Rains, 1989). In addition, an RCT by Forman and colleagues (2007) provided evidence that changes in "observing" and "describing" thoughts and feelings were stronger mediators for CT compared to ACT (presumably because they were integral to the process of investigating and disputing automatic thoughts), whereas changes in experiential avoidance, acceptance, and "acting with awareness" were stronger mediators for ACT compared to CT.

A number of important limitations exist for the current body of evidence on mediation. First, the overall quantity is low, with evidence for differential mediation especially thin. Second, the evidence for postulated mechanisms of action is mixed, particularly in the case of CT. Third, most mediational analyses have relied on a small number of contemporaneous measurements of mediator and outcome variables. Therefore, the presumed mediator may actually be a byproduct of treatment rather than a genuine mechanism of change (Johansson & Høglend, 2007). Further, given the small number of measurements, the studies have not modeled change over time in mediators or in outcomes, nor have they evaluated contemporaneous associations between mediators and outcomes when controlling for change in the outcome. Thus, little is known about the amount and type of change that occurs in mediators and outcomes over time.

In order to begin to address these concerns, for the present study we developed a brief measure of key mediation and outcome variables. As discussed above, the mediator conceptualized to drive change in standard CT is change in dysfunctional thinking (also commonly referred to as cognitive distortion or bias). For ACT, the variables that most closely tap the proposed mechanisms of action are increases in experiential acceptance as well as a willingness to engage in goal-directed behavior in the face of aversive affective experience. ACT also asserts that cognitive defusion would mediate outcomes as it facilitates willingness; however, CT implicitly invokes defusion through its emphasis on considering thoughts as hypotheses to be evaluated. The study measure (described below) thus taps each of these constructs, as well as symptom intensity (the standard CBT outcome construct, though one that has proven useable for studies of acceptance-based treatments as well), and progress toward goals (a broader outcome construct).

The current study thus aimed to measure both hypothesized mediators and outcomes by administering the abbreviated measure of mediators and outcomes continuously (i.e., at every session) to patients with mood or anxiety disorders randomly assigned to either ACT or CT. This design allowed the use of a more sophisticated analytic strategy, namely hierarchical linear modeling, to evaluate change over time in both the mediator and outcome, and to test associations between mediators and outcomes when controlling for changes in the outcome.

It was specifically hypothesized that increased utilization of cognitive-affective change strategies and reduction in dysfunctional thinking would be relatively stronger mediators of outcome of CT than of ACT, and that utilization of psychological acceptance strategies and willingness to engage in goal-directed behavior would be stronger mediators of ACT relative to CT. Given the two treatments' seemingly high overlap in defusion-like processes, it was predicted that no appreciable difference would emerge in the strength of any mediating effects of defusion.

Method

PARTICIPANTS

Participants were 174 students in the health science professions presenting for treatment at a university clinic, 101 of whom were part of an outcome-focused study comparing ACT and CT for anxiety and depression (see Forman et al., 2007, for a report on comparative effectiveness and more details on methodology). As a way of maximizing generalizability, inclusion criteria were set broadly, that is, all those presenting for ongoing psychological treatment (as opposed to one-time crisis counseling or to psychoeducational/neuropsychological evaluation) and who attended at least one session were eligible. Exclusion criteria were active psychosis or inability to read English-language measures. Data on patients screened, enrollment, allocation, and analysis/follow-up is presented in a CONSORT diagram (Figure 1).

The majority of participants were female (82.3%), 50.9% lived with a partner, 71% were White (11.6% Asian, 8.2% Black, 5.2% Latino) and their mean age was 27.87 ($SD = 7.25$; range = 18–52). A range of psychopathologies was observed, with 46.6% of the sample presenting with an anxiety disorder, 34.7% with a depressive disorder, and 6.3% with an adjustment disorder. On average, participants reported moderate levels of anxiety (Beck Anxiety Inventory $M = 12.60$, $SD = 10.97$) and depression (Beck Depression Inventory $M = 15.98$, $SD = 10.28$). As would be expected, these mean values are somewhat lower than those found in controlled trials where all participants have a diagnosis of depression or anxiety. However, the sample's

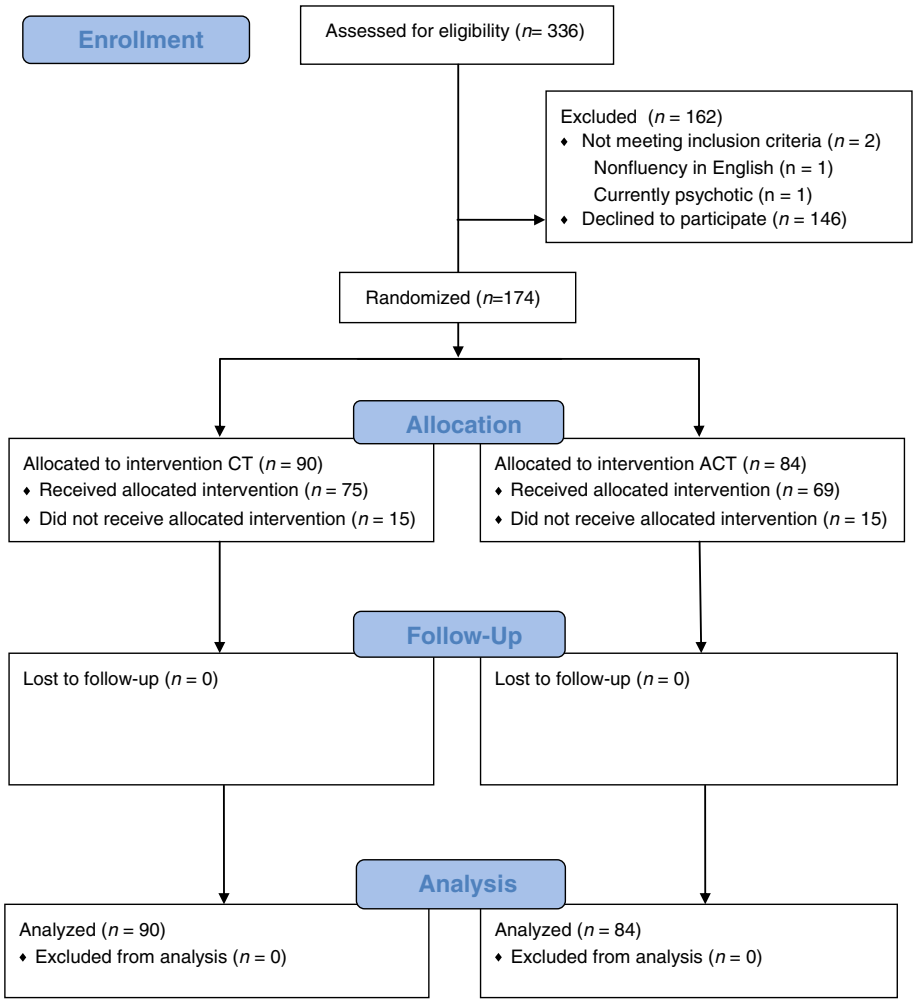

FIGURE 1 Consort diagram. *Note*. CT = Cognitive Therapy; ACT = Acceptance and Commitment Therapy; allocated intervention defined as six or more sessions of treatment.

overall functioning (as measured on the Outcome Questionnaire-45 [OQ-45; Lambert, Hansen, et al., 1996], which includes symptom distress plus role functioning) was highly impaired ($M = 76.94$, $SD = 17.07$) compared to community and clinical norms (Lambert, Burlingame, et al., 1996). In terms of psychiatric medication use, 14% reported use at baseline and 13% at posttreatment. (Consideration, in the model, of medication use, discontinuation, or beginning medication during treatment had no discernable impact on the results described below, and so were not included in the analyses.)

PROCEDURE

Patients presenting for treatment were offered the opportunity to participate in the study (with those declining receiving treatment as usual). Those providing consent were assigned to either the ACT or CT condition via stratified block randomization. Patients completed treatment outcome measures at baseline and at posttreatment. Randomization was blocked by symptom level, determined by total score on the OQ. Intake interviews were conducted by study therapists who determined diagnosis using the Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1997). Prior to each therapy session, patients completed the Before Session Questionnaire (BSQ), described below. To maximize external validity, there was no set number of sessions a patient could receive ($M = 15.34$, $SD = 13.56$); termination occurred when the patient and/or the therapist determined that presenting problems had been adequately addressed (mean duration: $M = 5.48$ months, $SD = 4.78$).

TREATMENTS

All participants received standard behavioral interventions (e.g., homework, skills training, BA)

considered relevant to treatment regardless of condition. Furthermore, nonspecific therapeutic components (e.g., active listening, empathy, goal setting) were integral to both treatment conditions. The difference between the two conditions was the overarching framework within which these skills and components were presented.

Participants randomized to the CT condition received a formal socialization to the CT model, which emphasized the role of distorted thinking in developing and maintaining psychopathology. The CT condition also included a discussion of automatic thoughts and core beliefs with instructions on cognitive restructuring, which included identifying automatic thoughts, labeling cognitive distortions, disputing cognitive thoughts, and generating alternate appraisals.

Individuals assigned to the ACT condition received an introduction to the ACT model, which underscored the role of experiential avoidance in maintaining psychopathology. Participants discussed how problematic efforts to control internal experiences had created psychological inflexibility. Exercises and discussion facilitated patients understanding of willingness, acceptance, the role of language in suffering, defusion, and mindfulness. Exercises in values clarification were also utilized to encourage value-driven living.

THERAPISTS

All therapy was provided by doctoral student therapists under the supervision of licensed psychologists who had extensive experience and training in both ACT and CT. Before the treatment phase, therapists participated in a comprehensive 30-hour ACT and CT training program. During the treatment phase, therapists received weekly individual and group supervision. Supervisors noted and addressed any issues involving fidelity, contamination, or competence on an ongoing basis, and these variables were assessed formally as described below.

TREATMENT FIDELITY

All sessions were audio recorded. To assess treatment fidelity and competence, three recordings from each patient were randomly selected and assessed independently by blind raters using a validated adherence scale (McGrath, Forman, & Herbert, 2009). Raters demonstrated excellent interrater reliability (intraclass correlation coefficient [ICC] values for the subscale scores ranged from .965 to .994) with a criterion rater who was highly experienced in delivering both treatments and using the measure. Across sessions, an average of 42.5% of time was spent on treatment-specific components (interventions that were called for by only one of the treatments, e.g., identifying cognitive distortions and challenging/restructuring automatic thoughts for CBT, and training in mindful/nonjudgmental awareness of internal experiences for ACT) and 2.3% of time was spent on aspects associated with the nonassigned treatment condition. The remaining time was spent on nonspecific interventions (e.g., empathic reflections) and behavioral interventions, such as behavioral exposure, common to both treatments. In addition, the blind raters were able to identify the correct treatment condition 84% of the time. Raters also judged therapist competence using a 5-point Likert scale, and determined it to be 4 (*very good*) or 5 (*excellent*) for 92% of the rated sessions.

EQUIVALENCE OF TREATMENT GROUPS

Participants in both treatments received a similar numbers of sessions (ACT $M = 16.15$, $SD = 14{,}62$; CT $M = 14.59$, $SD = 12.54$; $t(172) = 0.76$, $p = .45$), with equivalent numbers (ACT = 82.1%, CT = 83.3%) receiving what we had defined as an adequate dose (i.e., six sessions; $\chi^2 = 0.04$, $p = .84$). In addition, all therapists treated patients in both ACT and CT conditions, and each study therapist treated an approximately equal number of patients in each condition. The percentage of patients taking psychiatric medications at the start of treatment did not differ significantly across groups (ACT = 18%, CT = 6%; $\chi^2 = 1.99$, $p = .16$), and as mentioned, neither medication use nor medication discontinuation impacted results. As previously reported (Forman et al., 2007), the treatments produced large and equivalent decreases in depression, anxiety, and other symptoms, and a relatively large proportion of participants made clinically significant gains in terms of depression symptoms (61%), anxiety symptoms (55%), and overall functioning (38.3%) that were statistically reliable.

MEASURES

Before Session Questionnaire

The BSQ was designed for the purpose of this study as a brief measure of several potential mediating and outcome variables that could be administered very quickly before every session. The BSQ is a seven-item self-report measure with ratings provided on a 7-point Likert scale. Items measure outcome (*symptom intensity*, *progress toward goals*) and theorized mechanisms of change (e.g., *cognitive acceptance versus change*, *affective acceptance versus change*, *dysfunctional thinking*, *cognitive defusion*, *committed action*) in both ACT and CT (Table 1). In part to reduce experimenter demand, the acceptance versus change items were constructed so neither extreme of the response options appeared to be

Table 1
Constructs, BSQ Item Content, Validity Analysis, and Descriptive Statistics for Outcome and Mediator Variables

			Association With Full-Scale Measuring Similar Construct		Descriptives at Session 1: *M* (*SD*)
Outcome Variables					
	Question Prompt	Response (With Likert Anchor Points)	Full-Scale Measure	$r_{full\ scale}$	
Symptom intensity	The frequency and intensity of my specific symptoms or problems over the past week has been.…	Very low . . . very high	OQ	.34**	3.94 (1.49)
Progress toward goals	In considering my most important goals, I would rate my progress toward my goals over the past week as.…	A lot of progress . . . little progress	SLS	.42**	3.93 (1.30)
Mediators					
Utilization of acceptance versus change strategy: cognitive	Whenever I had bothersome thoughts over the past week, I tended to.…	Just notice them without trying to change them.… Try to change them.	PHLMS	.28*	4.30 (1.62)
Utilization of acceptance versus change strategy: affective	Whenever I had bothersome feelings over the past week, I tended to.…	Just notice them without trying to change them.… Try to change them.	PHLMS	.49**	4.33 (1.61)
Dysfunctional thinking	My thoughts tend to be.…	Unrealistically positive.… Fairly Accurate.… Unrealistically negative.	ATQ–Frequency	.47**	0.70 (0.74)
Cognitive defusion	When I have thoughts that I "know" are unrealistically negative.…	I am able to see them as just thoughts and not as the truth.… I can't help but take them as the truth.	ATQ–Believability	.46**	3.25 (1.50)
Willingness	In terms of the effect of my emotions on my behavior, my anxiety, depression, and other distress.…	Does not prevent me from doing anything of importance.… Prevents me from doing many important things.	AAQ	.41**	3.36 (1.49)

Note. OQ = Outcome Questionnaire; QOLI = Quality of Life Inventory; SWLS = Satisfaction With Life Scale; PHLMS = Philadelphia Mindfulness Scale; ATQ = Automatic Thoughts Questionnaire; AAQ = Acceptance and Action Questionnaire. Likert anchor points ranged from 1 through 7, but dysfunctional thinking computed as *difference* from "fairly accurate" = 4. *p<.05, ** p<.01.

the "right" answer, that is, a continuum where one side was "Just notice them without trying to change them" and the other was "Try to change them." The same rationale was applied to dysfunctional thinking such that the continuum ranged from "unrealistically negative" to "unrealistically positive." However, in this case, the item value was determined by calculating the deviation from the center value ("fairly accurate"), that is, the absolute value of the Likert score minus 4.

The questions on the BSQ are adapted from various established measures, including the Acceptance and Action Questionnaire (AAQ; Hayes, Strosahl, et al., 2004); Automatic Thoughts Questionnaire (ATQ; Hollon & Kendall, 1980), which has been modified by Zettle and Hayes (1986) to include a believability subscale to represent cognitive defusion; Philadelphia Mindfulness Scale (PHLMS; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008); Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985); Quality of Life Inventory (QOLI; Frisch, Cornell, Villanueva, & Retzlaff, 1992); and OQ (Lambert, Hansen, et al., 1996). An item was selected and then adapted from each established measure, on the basis that it was readily comprehensible and captured the essence of the construct.

As one measure of validity, individual items on the BSQ were correlated with the closest-corresponding established measure (M = .41, ps < .05; see details in Table 1), suggesting that these items were generally representative of the constructs they were designed to measure. Of note, the full measures were administered at the intake interview, and the BSQ items at the first session, which was normally one to three weeks later. Because individual items were designed to measure separate constructs, we did not evaluate internal reliability.

DATA ANALYSIS STRATEGY

Mixed-effects regression models (MRMs; Raudenbush & Bryk, 2002), with repeated BSQ

measurements (Level 1) nested within participants (Level 2), were used to test the hypotheses. Of note, participants were nested within 38 therapists; however, the results of preliminary analyses indicated that the proportion of outcome variance attributable to therapists (i.e., the ICC) was trivial, with ICCs of $<.01$ and $<.02$ for the symptom intensity and goal progress outcomes, respectively. As a result, a random effect was not modeled for therapists. Importantly, randomization to treatment condition occurred at the level of the participant, not the therapists. To accommodate the unevenly spaced measurement occasions across participants, linear and quadratic polynomial terms for each occasion were computed as the number of months from the treatment intake (Biesanz, Deeb-Sossa, Papadakis, Bollen, & Curran, 2004). The combination of each term's sign (i.e., positive or negative) indicates the overall shape of the trajectory with, for instance, negative linear and positive quadratic terms representing a decelerating negative slope, that is, more rapid initial reductions that slow over time (Hedeker & Gibbons, 2006). All models were estimated using HLM software (version 6.06; Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004) with restricted maximum likelihood estimation and using all available data for estimating slopes. Missing data (median number of sessions per patient = 2) occurred when clinic staff neglected to administer the BSQ to patients upon check-in at the clinic and was thus assumed to be missing at random. Model-building procedures detailed by Singer and Willett were utilized, and specification of random effects was based on the likelihood ratio test.

Of note, several features of the data limited the feasibility of alternative approaches to testing mediation. The number and spacing of sessions was widely variable across participants, and a sizeable portion of the sample was missing a BSQ administration at the first treatment session. The selected approach, detailed next, permitted flexible modeling of these data features while permitting tests for change over time in the putative mediators and outcomes. The primary limitation, however, is that the modeled association between mediator and outcome is time varying in nature rather than lagged, phase-specific, or parallel process. As a result, we cannot have high confidence in causal interpretations that arise from the model.

The model-building approach to testing the moderated mediation hypotheses consisted of two steps. First, tests for overall mediated effects, independently of treatment condition, were conducted. Second, the mediation models were modified to include intervention condition, testing for differences between ACT and CT on the outcome slope, putative mediator slope, and the time-varying association between the mediator and the outcome.[1] Tests for the significance of the overall mediated effect were conducted for all combinations of the putative mediators and outcomes (i.e., a total of 15 models). To limit the total number of tests conducted, tests for the significance of moderated mediation effects were conducted when there was evidence of a between-group (i.e., ACT vs. CT) difference on the mediator slope or on the time-varying association between the mediator and outcome (i.e., a total of six models).

The statistical tests for mediation were based on the product of coefficients test for mediation and other intervening variable effects, reviewed by MacKinnon, Lockwood, Hoffman, West, and Sheets (2002) and extended to multilevel applications by Krull and MacKinnon (2001). This test is based on the estimation of two coefficients and their standard errors. For the present hypotheses, the first coefficient, the "A-Path," represents the linear and quadratic change over time in the mediator. The second coefficient, the "B-Path," represents the time-varying association between the putative mediator and the outcome, holding constant the linear and quadratic change over time in the outcome. To test the moderated mediation hypotheses, a treatment group indicator (with ACT as the reference condition) was added to each of the above models.

The significance of the mediation and moderated mediation effects was evaluated using asymmetric confidence limits and critical values for the product of coefficients as implemented in PRODCLIN software (MacKinnon, Fritz, Williams, & Lockwood, 2007; MacKinnon, Lockwood, & Williams, 2004). Importantly, this method offers greater statistical power relative to the traditional "causal steps" approach to testing mediation using normal theory confidence intervals based on Sobel *SE*s (Krull & MacKinnon, 2001). To aid interpretation, C-Path results are also provided below, indicating the extent to which ratings of the outcomes change over time.

[1] To evaluate the extent to which outcome and putative mediator slopes varied by treatment dose or treatment completion status, the C-Path and A-Path growth models were modified to include, in separate models, a dichotomous indicator for treatment completion status (i.e., six or more sessions) and treatment dose (i.e., the log-transformed count of sessions completed). With two minor exceptions for the treatment completion status indicator, there were no significant differences by treatment completion status or treatment dose. Further, there were no significant differences by intervention condition. Given the small number of differences by treatment dose or completion status, subsequent models did not adjust for these variables.

Results

DESCRIPTIVE STATISTICS

Descriptive statistics for the BSQ items at Session 1 are provided in the last column of Table 1.

Do Ratings of the Outcomes Change Over Time? (C-Path)

C-Path results, and the results of models testing for differences in the C-Path by treatment condition, are presented in Table 2. For the symptom intensity outcome, there was significant negative linear and positive quadratic change in ratings over time, indicating that initial reductions occurred more rapidly and then slowed somewhat over time. As an illustration, the level of symptom intensity at the first session was 3.92 (*average*), and this changed to 3.04 after 6 months and 2.19 (*low–very low*) after 12 months. For the goal progress outcome, there was significant negative linear, but not significant quadratic, change in ratings over time, indicating that the rate of reduction was generally constant over time. The level of goal progress at the first session was 3.91 (*some*), and this changed to 3.37 after 6 months and 2.83 (between *some* and *a lot*) after 12 months. For each outcome, these terms did not differ significantly by treatment approach. Thus, participants reported clinically significant improvements on both symptom intensity and goal progress over time, and these improvements did not differ meaningfully for participants treated with ACT and participants treated with CT.

Do Ratings of the Putative Mediators Change Over Time? (A-Path)

A-Path results and the results of models testing for differences in the A-Path by treatment condition are presented in Table 2. For cognitive acceptance versus change and affective acceptance versus change, across both treatment groups, there was no statistically significant linear or quadratic change in ratings over time. However, there was significant negative linear and positive quadratic change over time for participants treated with ACT, indicating greater endorsement of cognitive and affective acceptance over time. The shape of this trajectory is such that initial decreases in ratings were more rapid and then slowed over time. For participants treated with CT, the linear change was significantly more positive and the quadratic change was significantly more negative relative to that for participants treated with ACT. For example, for ACT, the level of cognitive acceptance at the first session was 4.39, and this changed to 4.75 after 6 months and 5.10 after 12 months. For CT, the level changed from 4.21 to 3.12 to 2.05. Ratings did not differ significantly between the two groups at baseline. Thus, across groups, there was no evidence of change over time in cognitive or affective acceptance versus change. However, the differences between ACT and CT provide evidence of a potential source of moderated mediation, with participants treated with ACT reporting greater acceptance over time.

For dysfunctional thinking, cognitive defusion, and committed action, across both groups, there was statistically significant negative linear and positive quadratic change in ratings over time. The linear and quadratic terms did not differ significantly by treatment approach. Thus participants improved on dysfunctional thinking, cognitive defusion, and committed action over time and these improvements did not differ meaningfully for participants treated with ACT relative to participants treated with CT. As above, the shape of this trajectory is such that initial improvements were more rapid and then slowed over time. For example, the level of cognitive defusion at the first session was 3.30, and this changed to 2.57 after 6 months and 1.86 after 12 months. These results offer potential evidence for the mediating effects of these three variables but do not provide potential evidence for a moderated mediation effect.

Are Ratings of the Putative Mediators Associated With Ratings of Symptom Intensity and Goal Progress? (B-Path, C′-Path)

The B-Path and C′-Path results across treatment conditions are presented in Table 3, and the results for treatment condition differences are presented in the text below. Holding constant the effect of change over time in ratings of symptom intensity and goal progress, ratings of cognitive acceptance versus change and affective acceptance versus change were not significantly associated with ratings of the outcomes at the same session. However, there were significant differences in these associations by treatment condition. For participants treated with ACT, ratings of cognitive acceptance versus change were significantly positively associated with ratings of symptom intensity, $\beta = 0.151$, $SE = 0.053$, $t(172) = 2.86$, $p = .005$, and goal progress, $\beta = 0.167$, $SE = 0.050$, $t(172) = 3.37$, $p = .001$. Likewise, ratings of affective acceptance versus change were significantly positively associated with ratings of symptom intensity, $\beta = 0.154$, $SE = 0.048$, $t(172) = 3.18$, $p = .002$, and goal progress, $\beta = 0.142$, $SE = 0.047$, $t(172) = 3.00$, $p = .004$. Thus, for participants treated with ACT, greater acceptance at a given session was associated with improved symptom intensity and greater goal progress at the same session. For participants treated with CT, relative to those treated with ACT, ratings of cognitive acceptance versus

Table 2
C-Path Results Including Models Testing for Differences in the C-Path by Treatment Condition

	Across Interventions				By Intervention			
	β	*SE*	*DF*	*p*	β	*SE*	*DF*	*p*
C-Path (Outcome)								
Symptom Intensity								
Intercept	3.92	0.08	173	<.001	3.85	0.10	172	<.001
Treatment					0.14	0.16	172	.41
Linear	−0.15	0.03	173	<.001	−0.10	0.05	172	.03
Treatment					−0.09	0.07	172	.18
Quadratic	0.04*	0.01*	173	<.001	0.03*	0.02*	172	.15
Treatment					0.03*	0.03*	172	.20
Goal Progress								
Intercept	3.90	0.08	173	<.001	3.92	0.12	172	<.001
Treatment					−0.03	0.16	172	.87
Linear	−0.08	0.02	173	<.001	−0.07	0.03	172	.01
Treatment					−0.03	0.04	172	.51
Quadratic	0.03**	0.06**	2,285	.66	0.02**	0.07**	2,282	.75
Treatment					0.03***	0.01*	2,282	.98
A-Path (Mediator)								
Cognitive Accept Versus Change								
Intercept	4.30	0.10	173	<.001	4.21	0.11	172	<.001
Treatment					0.19	0.19	172	.34
Linear	−0.06	0.04	173	.15	−0.18	0.05	172	<.001
Treatment					0.24	0.07	172	<.001
Quadratic	0.09**	0.01*	173	.40	0.04*	0.02*	172	.02
Treatment					−0.04*	0.02*	172	.04
Affective Accept Versus Change								
Intercept	4.26	0.10	173	<.001	4.22	0.11	172	<.001
Treatment					0.09	0.19	172	.62
Linear	−0.06	0.04	173	.10	−0.19	0.04	172	<.001
Treatment					0.25	0.07	172	<.001
Quadratic	0.01*	0.01*	173	.35	0.04*	0.01*	172	.01
Treatment					−0.05*	0.02*	172	.01
Dysfunctional Thinking								
Intercept	4.50	0.06	173	<.001	4.49	0.09	172	<.001
Treatment					0.01	0.12	172	.92
Linear	−0.07	0.02	173	<.001	−0.08	0.02	172	<.001
Treatment					0.01	0.03	172	.69
Quadratic	0.02*	0.06**	173	<.001	0.03*	0.06**	172	<.001
Treatment					−0.04**	0.01*	172	.71
Cognitive Defusion								
Intercept	3.30	0.10	173	<.001	3.45	0.13	172	<.001
Treatment					−0.28	0.21	172	.18
Linear	−0.12	0.03	173	<.001	−0.15	0.04	172	<.001
Treatment					0.05	0.05	172	.44
Quadratic	0.03*	0.01*	173	.02	0.04*	0.02*	172	.02
Treatment					−0.02*	0.02*	172	.41
Committed Action								
Intercept	3.26	0.10	173	<.001	3.28	0.14	172	<.001
Treatment					−0.03	0.20	172	.87
Linear	−0.17	0.04	173	<.001	−0.14	0.05	172	.01
Treatment					−0.05	0.07	172	.45
Quadratic	0.05*	0.02*	173	<.001	0.03*	0.02*	172	.10
Treatment					0.03*	0.03*	172	.26

Note. To reduce trailing zeros and improve readability, marked values were multiplied by 100*, 1,000**, or 10,000***.

Table 3
B-Path and C′-Path Results

	Symptom Intensity				Goal Progress			
	β	*SE*	*DF*	*p*	β	*SE*	*DF*	*p*
B- and C′-Path								
Cognitive Accept Versus Change								
Intercept	3.91	0.08	173	<.001	3.93	0.08	173	<.001
Mediator	0.05	0.04	173	.23	0.02	0.04	173	.62
Linear	−0.10	0.03	173	<.001	−0.04	0.02	173	.05
Quadratic	0.03*	0.01*	173	.03	−0.03**	0.06**	2,262	.64
Affective Accept Versus Change								
Intercept	3.94	0.08	173	<.001	3.95	0.08	173	<.001
Mediator	0.05	0.04	173	.21	−0.37*	0.04	173	.91
Linear	−0.11	0.03	173	<.001	−0.05	0.02	173	.01
Quadratic	0.03*	0.01*	173	.01	0.01**	.06**	2,265	.82
Dysfunctional Thinking								
Intercept	3.83	0.08	173	<.001	3.84	0.07	173	<.001
Mediator	0.48	0.05	173	<.001	0.33	0.05	173	<.001
Linear	−0.10	0.03	173	<.001	−0.05	0.02	173	<.001
Quadratic	0.03*	0.01*	173	.03	−0.02**	0.06**	2,278	.73
Cognitive Defusion								
Intercept	3.78	0.08	173	<.001	3.80	0.07	173	<.001
Mediator	0.41	0.03	173	<.001	0.30	0.03	173	<.001
Linear	−0.08	0.03	173	<.001	−0.05	0.02	173	.01
Quadratic	0.03*	0.01*	173	.02	0.02**	0.06**	2,278	.68
Committed Action								
Intercept	3.75	0.07	173	<.001	3.77	0.07	173	<.001
Mediator	0.52	0.03	173	<.001	0.39	0.03	173	<.001
Linear	−0.07	0.03	173	.01	−0.03	0.02	173	.04
Quadratic	0.03*	0.01*	173	.01	−0.02**	0.06**	2,280	.75

Note. To reduce trailing zeros and improve readability, marked values were multiplied by 100* or 1,000**.

change were significantly more negatively associated with ratings of symptom intensity, $\beta = -0.195$, $SE = 0.075$, $t(172) = -2.60$, $p = .011$, and goal progress, $\beta = -0.277$, $SE = 0.068$, $t(172) = -4.09$, $p < .001$. Likewise, ratings of affective acceptance versus change were significantly more negatively associated with ratings of symptom intensity, $\beta = -0.203$, $SE = 0.070$, $t(172) = -2.90$, $p = .005$, and goal progress, $\beta = -0.271$, $SE = 0.065$, $t(172) = -4.15$, $p < .001$. Thus, for those receiving ACT, moving toward an accepting stance and away from a change-oriented stance was associated with symptom and goal-progress improvement. Yet, for those receiving CT, the opposite pattern was observed: movement *toward* a change orientation and *away* from an acceptance orientation was associated with improvement. Given that the time-varying association between the acceptance variables and the outcomes differed between ACT and CT, these findings provide potential evidence of a moderated mediation effect.

Holding constant the effect of change over time in the outcomes, ratings of dysfunctional thinking, cognitive defusion, and committed action at a given session were significantly positively associated with ratings of symptom intensity and goal progress at the same session. The associations did not differ significantly by treatment condition. Thus, independently of treatment group, improvement on these putative mediators was associated with improvement on outcomes, providing possible evidence of an overall mediation effect.

STATISTICAL TESTS FOR MEDIATION AND MODERATED MEDIATION EFFECTS

Based on the A- and B-Path results presented above, there was evidence of overall mediation effects for dysfunctional thinking, cognitive defusion, and committed action. That is, in each of these cases, across both treatment groups, there was significant change over time in ratings of the putative mediator (i.e., A-Path) and there was a significant time-varying association between ratings of the mediator and ratings of the outcome (i.e., B-Path). Results of the product of coefficients tests for the mediated effect with asymmetric confidence limits indicated that ratings over time of dysfunctional thinking, cognitive defusion, and committed action mediated linear change in ratings of symptom intensity (95% CI_{prod} [−0.032, −0.003], [−0.08, −0.03], and [−0.12,

–.04], respectively) and goal progress (95% CI_{prod} [−0.019, –0.002, [−0.06, –0.02], and [−0.09, –0.04], respectively); quadratic change did not reach significance (symptom intensity 95% CI_{prod} [0.000001, 0.000099], [0.000042, 0.000206], and [0.000156, 0.000368], respectively); goal progress (95% CI_{prod} [<0.000001, 0.00006], [0.000031, 0.000156], and [0.000116, 0.000279], respectively).

There was evidence of moderated mediation effects for cognitive acceptance versus change and affective acceptance versus change. That is, these putative mediators changed differently over time for participants treated with ACT and participants treated with CT. Further, the time-varying association between these putative mediators and the outcomes was different for participants treated with ACT and participants treated with CT. To obtain a slope and *SE* estimate for CT, additional models were estimated with CT coded as the reference category (i.e., 0). For participants treated with ACT, the results of the product of coefficients tests indicated that cognitive acceptance versus change mediated linear and quadratic change in symptom distress, 95% CI_{prod} [−0.05, –0.01] and [0.00001, 0.0001], and goal progress, 95% CI_{prod} [−0.06, –0.01] and [0.00001, 0.0001]. Also for participants treated with ACT, affective acceptance versus change also mediated linear and quadratic change in symptom distress, 95% CI_{prod} [−0.05, –0.01] and [0.00002, 0.0001], and goal progress, 95% CI_{prod} [−0.05, –0.01] and [−0.00002, –0.0001]. However, for participants treated with CT, cognitive acceptance versus change did not mediate linear or quadratic change in symptom distress, 95% CI_{prod} [−0.013, 0.004] and [−0.00001, 0.00003] or goal progress, 95% CI_{prod} [−0.022, 0.005] and [−0.00003, 0.00006], and affective acceptance versus change did not mediate linear or quadratic change in symptom distress, 95% CI_{prod} [−0.012, 0.003] and [−0.00002, 0.00003] or goal progress, 95% CI_{prod} [−0.024, 0.005] and [−0.00004, 0.00007].

Conclusions and Discussion

This study compared dynamic mediation of outcome for two prominent models of CBT (i.e., CT and ACT), using a very brief self-report measure administered across all sessions of psychotherapy. As such, it is one of the few studies to examine mediational effects continuously across time among patients randomized to alternate treatments (though we are limited regarding causal interpretation as mentioned below). As expected and consistent with prior findings, participants in both treatments evidenced robust and equivalent improvement in the self-reported intensity of their symptoms. In support of our central (mediational) hypotheses, however, treatment group moderated the mediating effects of both cognitive and affective changes strategies. Specifically, movement toward *cognitive and affective change strategies* (e.g., challenging and restructuring dysfunctional cognitions, distraction from unhelpful thoughts and feelings) facilitated outcome for those receiving CT, whereas movement toward the utilization of *psychological acceptance strategies* (e.g., viewing thoughts and emotions as acceptable as they are, with no need to alter or reduce them) facilitated outcome for those receiving ACT. These findings suggest that ACT and CT effect therapeutic change through different processes, which is in concert with the results of other studies (e.g., Forman et al., 2007; see also Hayes et al., 2006, in press, for a review).

Decreases in self-reported dysfunctional thinking and increases in patients' self-reported ability to step back psychologically from their thoughts and view them as mental processes rather than absolute truths (i.e., cognitive defusion) was an equivalent mediator for both treatments. In certain respects, the present results run counter to the notion that cognitive change differentially mediates outcome for CT, a supposition that has been under increasing scrutiny because of its direct bearing on the central thesis of cognitive therapy (Longmore & Worrell, 2007). Although cognitive restructuring is a core feature of CT, and defusion is a core target of ACT, it seems likely that the strategies have similar impacts on patients. For example, in order to practice cognitive restructuring, patients must achieve a degree of psychological distance from their cognitive experience in order to observe and analyze it. This finding supports the hypothesis that therapeutic change is facilitated by increasing defusion from and acceptance of one's distressing internal experience (Herbert, Forman, & England, 2009). Within cognitive therapy, this phenomenon is known as *metacognitive awareness*, described as "the cognitive set in which negative thoughts . . . are seen as passing mental events rather than as aspects of self" (Teasdale et al., 2002, p. 277). According to some cognitive therapists, certain strategies specific to traditional CT (e.g., cognitive restructuring) can help individuals relate differently to their psychological state (Teasdale et al., 2002; Teasdale, Segal, & Williams, 1995). For example, Teasdale and colleagues (2001) suggested that CT might foster a shift in thinking from "identifying personally" with thoughts to seeing such thoughts as individual parts of a larger mental experience. Ingram and Hollon (1986) hypothesized that CT's effectiveness was partly due to its emphasis on teaching patients to move from an *automatic* mode of processing to a *metacognitive* one. Similarly, ACT patients who

practice defusion regard thoughts as mental events and not necessarily as an accurate representation of reality, which is likely to result in an ultimate judgment of one's circumstances that is more accurate. Thus, both defusion exercises within ACT and cognitive restructuring exercises within CT may operate by increasing metacognitive awareness. Further research is needed to clarify the role of metacognitive awareness in the amelioration of psychopathology.

Because of ACT's intensive focus on enhancing willingness to engage in goal-directed behavior despite negative thoughts and feelings, it was hypothesized that this variable would be a stronger mediator for ACT than CT. However, this hypothesis was not supported; willingness was an equivalent mediator for both treatments. One explanation for this finding is that behavioral elements of both CT and ACT effectively encourage engagement in behavioral activity regardless of distressing thoughts or emotions.

These last two findings raise questions about the specific techniques prescribed by the two frameworks. For example, to the extent that defusion/metacognitive awareness is the central mechanism of action of these therapies, the question arises as to whether it is necessary to utilize explicit cognitive restructuring or defusion techniques, or whether metacognitive awareness occurs regardless of specific technique. There is a body of research questioning the added utility of cognitive change strategies (e.g., Longmore & Worrell, 2007). Similarly, are specific willingness-enhancing strategies necessary if patients will engage in goal-consistent behavior via commonsense encouragement? These questions highlight the need for further research on treatment processes, including both mediational and experimental component analysis studies.

One limitation of the current study is the lack of a fully validated assessment tool. Essentially, psychometric assurances were traded for the ability to obtain a snapshot of several factors in a brief assessment just prior to each session. Somewhat assuaging such concerns about psychometrics is the fact that the single items were generally associated robustly with previously validated, full-scale measures of their corresponding constructs. Additionally, the associations we analyzed between hypothesized mediators and the outcomes were time varying in nature. Although the models controlled for change over time in the outcomes, the coefficient of interest was based on ratings of mediators provided at the same time as ratings of outcomes. Thus, although the analyses were well tailored to the features of the data, the results cannot address questions of timing and causality. Other approaches could include the use of SEM-based approaches such as parallel process mediation models. Another limitation is that—like most investigations of mediation—this study relied on patient self-reports that may simply reflect the extent to which patients are explicitly or implicitly responding to be consistent with the demands or expectations of their treatment rather than actual changes in the target constructs. Of note, however, the bidirectional nature of some BSQ anchor points (e.g., "just notice them without trying to change them . . . . Try to change them") was designed to reduce the extent to which patients would regard one direction as "better." Also, self-reports depend on patients' ability to know and remember their own mental processes, which is surely far from perfect. In addition, we cannot be sure that all participants regard the meaning of the phrase "self-report items" (e.g., personal goals) equivalently, and the meaning may even vary as a function of treatment received. It should also be pointed out that follow-up data were not collected, precluding our ability to draw conclusions about maintenance of treatment effects.

Countering these limitations, the current study demonstrated several strengths. Mechanisms of action were compared across two active treatment conditions to which participants were randomly assigned. Additionally, we implemented strong checks on fidelity and allegiance, thereby raising the confidence level of the integrity of and distinction between treatment conditions. Finally, the current study used session-by-session measurement and an advanced mediational analytic strategy. The vast majority of treatment research examines changes from pre- to posttreatment, with a subset of these studies assessing the variables of interest midway through treatment (Kazdin, 2003). Session-by-session analyses, and corresponding multilevel analytic strategies, allow researchers to examine change over time and potentially make inferences of causality with regard to mediators of treatment outcome (MacKinnon, Fairchild, & Fritz, 2007). Additionally, mediation analyses that utilize multilevel models take into account the clustering of data (i.e., observations that are not independent are nested within the individual), thus preventing inflated Type I error rates (MacKinnon, Fairchild, et al., 2007).

In sum, this study examined the extent to which session-by-session changes in potential mediators predicted session-by-session changes in outcome among a group of patients randomly assigned to either CT or to ACT. The finding that certain mediators were moderated by treatment (utilization of acceptance vs. change strategies) and others

appeared equivalent across conditions (defusion, willingness) represents a step toward understanding the theoretical underpinnings of models of CBT.

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