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## Advancing the Assessment of Dynamic Psychological Processes

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### Abstract

Most commonly used clinical assessment tools cannot fully capture the dynamic psychological processes often hypothesized as core mechanisms of psychopathology and psychotherapy. There is therefore a gap between our theories of problems and interventions for those problems and the tools we use to understand clients. The purpose of this special issue is to connect theory about clinical dynamics to practice by focusing on methods for collecting dynamic data, statistical models for analyzing dynamic data, and conceptual schemes for implementing dynamic data in applied settings. In this introductory article, we argue for the importance of assessing dynamic processes, highlight recent advances in assessment science that enable their measurement, review challenges in using these advances in applied practice, and adumbrate the articles in this issue.

### Keywords

psychological assessment; dynamics; processes; idiographics

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Although theories about the development, manifestation, maintenance, and treatment of psychopathology are rooted in the description of *dynamic psychological processes*, clinical assessors rely heavily on *static tools* that are designed to capture dispositions (e.g., “Rate how you feel generally”) or behaviors that are aggregated over time (e.g., “Rate how you have felt during the past two weeks”). Despite their well-established validity, common dispositional and aggregated assessments may gloss over clinically important functional details about how behaviors manifest across time and context. The availability of tools to assess how behaviors change in a manner that corresponds more directly to dynamic conceptual models of dysfunction and intervention would significantly enhance clinical assessment. Fortunately, recent developments in assessment science make this possibility increasingly tractable. This special issue was organized to advance clinical assessment by highlighting and demonstrating recent advances in the (a) measurement of dynamic

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processes, (b) modeling of dynamic data, and (c) implementation of dynamic assessments in practice.

## What Do We Mean by Dynamic Psychological Processes?

A dynamic psychological process is a sequence of thoughts, feelings, and behavior that plays out over time. Dynamics may occur within or across contexts, and within or across individuals. Specific well-known clinical examples include affect dysregulation, defense mechanisms, mood lability, self-fulfilling prophecies, maladaptive self-regulation, rigidity, habituation, behavioral activation, and treatment response. At a more general level, the definition of most forms of psychopathology is, at least in part, dynamic. Certain disorders, such as borderline personality, bipolar disorder, tolerance–withdrawal sequences in substance abuse, obsessive–compulsive or binge–purge sequences, and intermittent explosive disorder, have the notion of lability or cycling at their core. Others are understood as variations from normal functioning of a certain duration, as in the case of depression versus sadness or personality disorder versus stress reaction, and some forms of psychopathology are understood to vary systematically across contexts, such as social phobia or posttraumatic stress disorder. Interventions are also typically construed in dynamic terms, in the sense that they are designed to change behavior. Moreover, well-validated interventions often include sequenced strategies designed to disrupt or alter certain kinds of pathological processes, as in the case of exposure and response prevention or rupture–repair cycles in the therapeutic alliance.

## Why Should We Assess Clinical Dynamics?

The relatively gross level of analysis measured by common clinical assessment tools, such as baseline personality assessments, diagnostic interviews, or follow-along measures administered every few sessions, is striking for its limited correspondence to clinical theory in this context. Routine assessment measures capture an incomplete picture of the inherently dynamic clinical formulations and treatment plans that are of typical clinical focus. In this special issue, we emphasize the importance and increasing possibility of making evidence-based inferences directly using repeated assessments tethered to the time scale of clinically relevant psychological processes.

This is important because the reliable and valid assessment of clinical dynamics would provide a major step toward understanding the *mechanisms* involved in adaptive and maladaptive behavior. As Casadevall and Fang (2009) analogize, descriptive science provides information about “who,” “what,” “where,” and “when,” whereas mechanistic science focuses on “how” and “why,” or the “stepwise explanation(s) of how system components interact to produce an outcome” (p. 3517). Understanding the mechanisms of behavior enables scientists and clinicians to identify the targets for disrupting psychopathology and promoting psychological health. For instance, different interventions might be appropriate for a patient who binge eats under stress than for a patient who binge eats when bored, even though the symptom is the same. However, as Casadevall and Fang (2009) also note, “Descriptive” and “mechanistic” are not antonyms and instead frequently reflect different levels of understanding of the same phenomena. Whereas the assessment of

dynamic psychological processes may in some instances lead to a mechanistic understanding, revealing the “how” and the “why,” in many others it will still be descriptive, providing answers to the questions of “who,” “what,” “where,” and “when.” In either case, assessing dynamics directly will move us toward a mechanistic understanding by providing greater specificity and proximity to the core phenomenon of interest.

## Opportunities in the Assessment of Dynamic Processes

Although the interest in measuring fine-grained psychological processes is by no means new, recent advances in data capture and statistical tools allow for exciting new opportunities. For instance, technological innovation, including portable handheld computers, sophisticated mobile sensors, and global positioning systems, permit investigators and clinician to pose questions and sample behavior in an individual’s natural environment repeatedly in real time. Other advances like low-cost, high-definition video recordings and computer vision algorithms unencumber those interested in studying behavioral processes from labor-intensive coding. These new technologies for data capture generate impressively large amounts of data, and therefore benefit from the similarly brisk pace of innovation in data storage (e.g., cloud computing) and analysis as a result of low-cost, powerful computing.

Another crucial component has been the advances in statistical techniques and tools that allow for analyzing dynamic data in ways that were either too challenging or remained available to only a select few in the past. Advances in time– series analysis, multilevel modeling, structural equation modeling, dynamical systems analysis, and machine learning, to name a few, enable the conversion of large amounts of data in to powerful clinical insights. The hope is that if these advances can be leveraged, basic research will lead to a more mechanistic understanding of human behavior and ultimately to more precise and rapid interventions via evidence-based dynamic clinical formulations.

## Challenges in the Assessment of Dynamic Processes

Several ongoing challenges need to be addressed to advance the assessment of dynamic psychological processes. Perhaps most important, current theories are generally not sufficiently specific to define the timing and scale of the processes of interest at a level that provides direct implications for psychological assessment. Do processes of interest play out over seconds, hours, days, or weeks? Regardless of time scale, are they tied to specific events or contexts? Do they unfold within a circumscribed event or context, or do they play out across contexts? Moreover, nuanced psychological processes are likely complexes that play out on different temporal levels (see, e.g., Figure 1 in Carpenter, Wycoff, & Trull, **IN PRESS**). This poses a challenge, because as Collins (2006) argues, the most powerful longitudinal inquiries will be those that tightly match the timing of the theoretical process of interest with the assessment schedule and statistical model. Adequate assessments of temporal processes require careful consideration of the timing of the mechanism. At the same time, in many cases there may be little to go on, highlighting the need for iterative empirical study and theoretical revision (Meehl, 1978).

Another complicated issue involves selecting the appropriate statistical techniques for evaluating dynamic data. The basic psychometrics of individual differences, on which much of the current assessment literature is based, will not suffice (Molenaar, 2004). Though increasing in availability and accessibility, courses on the necessary techniques are not widely taught. For these methods to receive widespread use, they will need to be taught more routinely in graduate programs. Currently, many graduate students do not even receive extensive training in foundational methods, such as time-series analysis and multilevel modeling, which impedes their ability to work with dynamic data. User-friendly data collection and analytic software will also need to be developed before such methods are likely to be used in applied settings. Currently there are very few dynamic assessment systems that could be easily transported to clinical practice; so even with the current advances, dynamic data are relatively expensive and time-consuming to collect.

Finally, as methods mature, research will be needed to show incremental value beyond what can be gained through traditional dispositional or time-aggregated assessments. This critique is not unique to dynamic assessments, as evidence is sparse for the incremental utility of standard assessments for a host of outcomes (e.g., more rapid treatment gains), and some of our most expensive assessment tools (e.g., fMRI) have little demonstrated practical utility as of yet. Nevertheless, given that the ultimate goal of assessment is to understand an individual in order to effect some sort of improved outcome, this improved outcome needs to be demonstrated empirically for novel, dynamically sensitive assessment tools.

## The Special Issue

This special issue is divided into three sections that correspond to the major challenges in moving toward the routine assessment of dynamic psychological processes. The first two articles are devoted to measurement concerns or data capture. Girard and Cohn (**IN PRESS**) discuss issues involved in the use of observational measurement to collect dynamic data in controlled settings, such as the laboratory or consulting room. In their coverage they range from the importance of the fundamentals, like selecting an appropriate temporal scale and establishing reliability and validity, to the cutting-edge use of computers to automate coding of complex behaviors. Automated behavioral coding, largely the domain of the computer sciences, is a particularly promising avenue for studying dynamic psychological process because it greatly alleviates burdensome manual coding and can capture complex clinically relevant behavioral sequences (e.g., Girard et al., 2014; Ramseyer & Tschacher, 2011). The second article in this section focuses on “new adventures” in ambulatory assessment (AA), an increasingly well-established method for assessing people in their lived environments. Carpenter, Wycoff, and Trull (**IN PRESS**) discuss the opportunities and challenges associated with instrumented AA (e.g., ambulatory psychophysiology), which is an area of rapid expansion in recent years as portable sensors are becoming cheaper and more widely available.

The second section includes four articles that address the quantitative modeling of dynamic processes using intensive longitudinal data. In the first of these articles, Bringmann et al. (**IN PRESS**) show how features of dynamic affective networks calculated from AA data are associated with individual differences in dispositionally measured neuroticism. The results

reveal that individuals higher in neuroticism also have denser affect networks. That is, the associations among AA sampled affects show stronger within-person links or coupling, which hints at processes that might drive higher trait levels of negative affectivity. Using this approach, Bringmann et al. study individual differences in intraindividual processes (Nesselroade, 1991). In contrast, Hamaker, Grasman, and Kamphuis (**IN PRESS**) adopt an idiographic modeling approach, showing how diverse time-series models can (a) be matched to theoretically plausible affective dynamics in bipolar disorder and (b) fit to a single individual's data in order to understand the specific nature of the mood fluctuation over time. Among the techniques presented by Hamaker et al. are hidden-Markov or regime-switching models, which hold promise for studying theoretical processes that involve individuals shifting between different states (e.g., manic and depressed states in bipolar disorder). Next, Beltz, Wright, Sprague, and Molenaar (**IN PRESS**) showcase how a recently developed modeling technique, Group Iterative Multiple Model Estimation, addresses the long-standing tension between idiographic and nomothetic analyses by estimating both group (i.e., nomothetic) and person-specific (i.e., idiographic) parameters. Beltz et al. examine day-to-day processes in AA data among personality disorder patients, finding that certain processes are general to all individuals, differing only in degree (e.g., negative affectivity predicts detachment), but others are unique to some individuals (e.g., hostility predicts negative affectivity). Departing from the focus on the individual, Gates and Liu (**IN PRESS**) provide an overview of available models for studying dyadic processes as they occur over time. As Gates and Liu point out, these methods can be flexibly applied to multivariate data and extended to more than two individuals. Importantly, all of the modeling approaches presented in this section are designed to or can be adapted to be applied to a specific individual, as is the most likely interest in clinical assessment practice.

Following the modeling section, four articles are presented to demonstrate how dynamic assessment techniques can be applied to clinical case data. In the first article, Matthews et al. (**IN PRESS**) describe the development of a smartphone-based application for tracking social rhythms in bipolar disorder. This application leverages the advanced portable technology embedded in a smartphone (e.g., microphone, electronic time stamping) to enhance an existing assessment rooted in a theoretical model of dynamic social processes. In so doing, this application addresses major challenges associated with traditional assessments of social rhythms in bipolar disorder. Next, Wright et al. (**IN PRESS**) use an idiographic modeling approach,  $p$ -technique factor analysis applied to AA data, to estimate theoretically derived dynamic models of individual patients diagnosed with borderline personality disorder. Their results point to striking differences in between- and within-patient personality structure over time. In a similar approach, Fisher and Boswell (**IN PRESS**) use dynamic factor analysis to develop idiographic models of depression and anxiety for patients leading up to psychotherapy. They describe how they use these models to prioritize treatment steps in a modularized therapy for internalizing psychopathology. Although in its early phases, this program of research has the potential to enhance personalization in psychotherapy through dynamic psychological assessment. Finally, Hopwood et al. (**IN PRESS**) describe a clinical supervision team that is organized around dynamic assessment and offer a case presentation involving a multimethod assessment that includes self- and informant report questionnaires, narrative methods, daily diaries, and behavioral codes of psychotherapy sessions. The use of

the same theoretical model for variable selection across the different assessment modalities provides for a coherent and relatively comprehensive formulation of the patient's dynamics that leads directly to testable intervention hypotheses.

Finally, Thomas Dishion, whose program of work spans assessment and intervention, with deep consideration of the dynamic psychological processes that underlie the phenomena he studies, provides commentary on the articles in this special issue (Dishion, **IN PRESS**). He focuses on the potential for dynamic assessment to reveal basic functional processes implicated in psychopathology and psychotherapy.

## Conclusion

A central interest in clinical psychological science and practice is understanding the mechanisms that underlie thought and behavior. Clinical interventions for psychiatric symptoms and behavioral problems target the etiological and maintenance mechanisms of problematic functioning. A mechanistic understanding of both normative and abnormal psychological phenomena requires the assessment of *dynamic processes*, yet these have traditionally been difficult to assess due to challenges with the measurement, modeling, and implementation of the appropriate data. Therefore in many areas of basic behavioral and clinical science, measuring the nuances and complexities of hypothesized dynamic processes and mechanisms has been consigned to cross-sectional tools. However, advances in data collection techniques and statistical modeling are rapidly changing the landscape of what is available to researchers and clinicians. Despite these advances, many significant challenges remain. This special issue brings together leading experts to demonstrate methods for assessing dynamic processes, models for analyzing dynamic data, and schemes for implementing dynamic data in clinical practice in order to advance the agenda of a rigorous yet practical dynamic assessment science.

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