

Within-Person Variability

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Abstract

From its emergence at the beginning of the 20th century, personality scientists pursued two goals – a nomothetic approach that investigated the structure of individual differences between people in a population and an idiographic approach that explored variation within a person relative to him or herself. In this chapter, we first track the how the history of these two perspectives impacted the study of within-person variability. Next, we review findings and unanswered contemporary questions regarding within-person variability. Finally, we conclude by providing questions for future research, some of which were proposed by early personality theorists but progressed slowly due to a lack of adequate methods. We outline cutting-edge statistical models and idiographic techniques to move the study of within-person variability – and personality science – forward.

Keywords: personality, within-person variability, idiographic

"Mankind is made up of inconsistencies, and no man acts invariably up to his predominant character. The wisest man sometimes acts weakly, and the weakest sometimes wisely."

Lord Chesterfield

From its inception, personality psychology had at least two distinct goals – to describe how people differed from one another on shared attributes (a nomothetic approach) and to describe and explain individuals holistically (an idiographic approach), with a focus on why people behaved similarly or differently across time and contexts. Although the term “within-person variability” did not reach mainstream use until the 21st century, it has rich historical roots in intensive idiographic examinations of individuals that generally required observing an individual repeatedly over time and contexts. Indeed, in the early years of personality psychology, many prominent theorists were drawn to the study of idiographic personality, likely stemming from personality being a historical outgrowth of clinical psychology (Allport, 1937; Windelband, 1894, 1904). The distinction between nomothetic and idiographic approaches was reflected in methodological differences within the field, still seen today in the tension between qualitative and quantitative approaches. While nomothetic approaches have relied on quantitative models, idiographic approaches primarily exist in psychobiography and clinical work (e.g., Barenbaum & Winter, 2008; McAdams, 1997). Recent methodological advances, however, suggest that idiographic approaches and the study of within-person variability are poised for a resurgence using rigorous methodological and quantitative techniques.

Nomothetic approaches dominate the study of personality psychology, partly due to advanced assessment techniques and statistical methods that were (historically) more appropriate for nomothetic, compared to idiographic, questions. Perhaps no technological advanced fueled

the study of individual differences more than the introduction of psychometric techniques and factor analysis in the beginning of the 20th century. In addition to the rise of factor analysis contributing to the adoption of personality traits as the key units of personality psychology, two founding fathers of personality, Gordon W. Allport and Raymond B. Cattell, adopted traits into their theoretical and empirical studies of personality. Understanding personality in terms of trait units opened up many new questions regarding the number of traits, the nature of those traits, and the organization of traits. Evidence that traits show long-term stability and predict numerous life outcomes (e.g., Beck, Specht, Bleidorn, & Jackson, 2020; Jackson, Connolly, Garrison, Leveille, & Connolly, 2015; Specht, Egloff & Schmukle, 2011; Weston, Hill, & Jackson, 2015) has cemented the nomothetic, trait approach as the dominant paradigm within personality psychology.

Unlike nomothetic approaches, the idiographic study of personality and within-person variability did not benefit from the same advancement in strong methodological tools. Although there was crucial theoretical development in the study of idiographic personality that began in the beginning of the 20th century and continued throughout the rest of it, the lack of available methods for testing these questions led to a decrease in popularity of idiographic methods within the field of personality. Recently, however, advances in measurement and modeling techniques have sparked interest in investigating within-person variability.

In the present chapter, we focus on the study of within-person variability in the field of personality. First, we outline its historical precursors and roots, discussing the promises early thinking on within-person variability and idiographic methods offered the field as well as early challenges it faced. Second, we discuss recent developments in the study of within-person variability, including the introduction of experience sampling methods (ESM) and multilevel

models (MLM) that brought within-person variability back to the fore in personality. Finally, we chart our vision for the future of the study of within-person variability in psychology, highlighting methodological and statistical tools from other areas of science and psychology that offer promising new insights in personality.

Early Conceptualizations

“Perfect consistency will never be found and must not be expected” (Allport, 1937, p. 330).

At the turn of the 20th century, advances in assessment and psychometrics gave nomothetic approaches to personality a key advantage over within-person approaches. Allport and Odbert (1936) promulgated a lexical hypothesis of personality traits in the early 20th century that remains an important historical precursor to modern work on personality trait structure. According to the lexical hypothesis, a useful way to understand how individuals differ from another is to look to the language that people use to describe themselves and others. Self-ratings of these adjectives became the precursor of the nomothetic personality trait inventories that dominate today.

However, Allport was a reluctant adopter of nomothetic approaches to personality, which he termed “common traits.” What common traits do capture are the measurable aspects of complex, individual (or idiographic) traits. The task for those interested in common traits, Allport argued, was to employ the methodological and statistical tools that made the measurement as precise and “serviceable” (Allport, 1937, p. 300) as possible. In other words, although Allport was a staunch advocate of an idiographic conceptualization of personality, he recognized that such assessment could, in some cases, be more detailed and intensive than was necessary. In such cases, it would be useful to reduce complex sets of data into simpler sets that allowed for simpler measurement. To this end, he was a staunch advocate of (1) the use of factor

analysis as an aid when a priori specification (i.e., the structure, number, or content of the common trait was not known beforehand) was insufficient and (2) of the use of profiles that place common trait measurements in the context of one another.

To Allport, traits “existed” at two levels, within a person and between people. Allport clearly stated that the profile of a single person across a number of common traits will never accurately capture the personality of an individual – that is, he believed that traits only truly existed at the level of the individual. Despite that common traits would never accurately portray the personality of a single person, Allport recognized that the utility of assessments depended on the goals of a researcher or therapist and that differentiating people from one another could also be an important goal. “Common” (nomothetic) trait approaches capture gradation in traits that are useful when interested in the relative standing of individuals (i.e., in rank-ordering individuals). However, Allport favored the within-person (individual) conceptualization of traits. Nomothetic approaches contained inherent error in the sense that, within an individual, each trait was unique as it was based on an individual’s “unique hereditary endowment, the different developmental history, and the never-repeated external influences that determine each personality” (Allport, 1937, p. 297). Nomothetic traits could not capture all of those unique components.

Indeed, in his seminal book *Personality, A Psychological Interpretation*, Allport (1937) defined personality as “the *dynamic* organization *within the individual* of those psychophysical systems that determine his unique *adjustments* to his environment” (p. 48; emphasis added). These “personal dispositions” were core features of his theory of personality. Two pieces of this definition are of particular note. First, personality is organized within an individual, not between them, meaning that to understand a person, one needs to study the personality processes relevant

to him or herself. Second, in saying that this organization is dynamic and reflects adjustments to one's environment, Allport highlighted that there was little reason to assume that personality traits would be consistent across time and situations. Indeed, nearly three decades later, he wrote "...we must admit at the outset that no trait theory can be sound unless it allows for, and accounts for, the variability of a person's conduct" (Allport, 1961, p.333).

Despite writing on the importance of within-person variability for a theory of personality, Allport himself did not systematically investigate it or its sources. To understand the individual, Allport (1961) reasoned that the lexical hypothesis extended to individual-level traits as well, and one could turn to the some 17,000 available trait names to characterize personality at the level of the individual. To demonstrate the convergence of the two methods, he recruited 39 judges to read a series of 172 published *Letters from Jenny* (Allport, 1965) and provide the trait adjectives that best described her. The judges provided adjectives that fell into roughly eight clusters. The letters were also coded for 99 tag words, and the frequency of the use of the tag words associated with one another in each letter was subjected to factor analysis. The resulting dimensions, which he called "factorial traits," largely converged with the clusters provided by the judges, which he called "common-sense traits." Both included aggression, autonomy, and affiliative terms. However, some terms were unique to each method, with, for example, judges identifying a "cynical-morbid" trait for which the coding had no analogue, and the coding providing a sexuality factor that the judges did not. Allport was careful to highlight that the resulting structure was a *structure of Jenny's personality*, not a set of dimensions that meaningfully differentiated her from others. Nonetheless, it is striking and important that the two methods converged on similar results, which highlights the ability to find consistent patterns even across varying contexts (in this case, letters).

Although Allport did provide a strong theoretical framework for understanding personality both within- and between-person, he focused on methods that captured the structure of personality between and within-person, rather than the methods necessary for the comprehensive study of the dynamics that he argued characterized personality. For that, we turn to Raymond B. Cattell. In the latter half of the 20th century, Cattell (1957) wrote and published a seminal book *Personality and Motivation: Structure and Measurement* that introduced several methodological and conceptual ideas that helped personality move towards a science of within-person variability. In introducing the *data box*, Cattell (1946) argued that persons could be conceptualized into 3-dimensions that indexed people (P_1 to P_n), variables (X_1 to X_p), and occasions or time (T_1 to T_t). The questions asked and answered by personality psychology, he argued, depended on how one sliced the data box. For example, typical nomothetic questions focus on the person (P) and variable (X) dimensions and collapse across the occasion (T) dimension, thereby addressing the question of the structure of individual differences within a population of people, which he termed *R-technique* (see Figure 1a).

Cattell was a pioneer in moving both the science of between person differences and the study of within-person variability forward. He noted that by slicing the data box into variable (X) and occasion (T) dimensions and fixing the person dimension, one can capture the unique structure of individual differences for a single person – that is, the within-person structure of personality. Cattell formalized these under the umbrella of *P-technique* (see Figure 1b), in which factor analytic models were applied to $X \times T$ matrices for individual people (Cattell, 1943).

His writings on the occasion (T) dimension, in particular, moved beyond Allport's acknowledgement that personality was dynamic. To Cattell, the occasion (T) dimension captured adjustment to one's environment and highlighted important considerations in understanding

people. He argued that whether the structure of within- and between-person individual differences were equivalent was an empirical question, but that considerations of how states vary over time offer reason to believe that congruence between individual-level personality structure and between-person personality structure is unlikely. He took that within-person variability in manifestations of personality was a given (thus, capturing observations over time was important), and that ascertaining the relative causes of that was a key methodological issue within the field. Indeed, three components of the needed methodology are particularly striking. First, he argued for the need to understand the relative amplitudes (level) and frequencies (time) of different kinds of fluctuations. Second, any ordered series should be tested for trends in order to separate out cyclical and non-cyclical fluctuations. Finally, both cyclical and non-cyclical trends should be traced to either internal or external causes.

The marriage of data driven techniques, like P-technique, with theoretical models of personality emphasizing the importance of studying individuals as unique, integrated wholes, should have been a fundamental shift in the study of individual differences. However, it took nearly 50 years before there were any large-scale investigations of personality using P-technique, in part because of the difficulty of collecting large enough matrices of variable (X) by occasion (T) data. Even when such data could be collected, it rarely, if ever, encompassed the full personality space as did data ($N \times X$) used for R-technique approaches (Cattell, 1946).

New data collection techniques at the end of the 20th century made it easier and more efficient to collect data matrices appropriate for P-technique, which led to a small handful of efforts in applying P-technique to broader sets of personality-relevant variables. The first of these, conducted by Borkenau and Ostendorf (1998), included within-person Principle Components Analysis (PCA) on a set of 90 observations of 30 personality variables from 22

individuals. The R-technique structure, obtained using average scores for each person across the study period, yielded a solution strongly resembling the most common Big Five structure.

However, the P-technique structures of the individuals fit much worse, suggesting that averaging over time misses important variation in the structure of individual differences. In other words, R-technique solutions are unlikely to capture the structure of a single individual's personality.

Other follow-up investigations by Molenaar (2004) and Beck and Jackson (2019) provided convergent evidence of these findings. Averaging over occasions (T) and ignoring within-person variability missed important variability that is crucially informative about individual differences.

While trait theories were popular during the mid 20th century and continued to increase in popularity, idiographic theory and assessments were also quite prominent. Henry Murray was a key figure in idiographic assessment and thus the study of within-person variability (Epstein, 1979a). Despite this, many were critical of Murray's work, saying that his single case-study approach was inadequate to answer the questions he was interested in. To justify the scientific basis of his work, Murray and his research group worked to develop procedures for idiographic assessment. Ultimately, this resulted in a "diagnostic council" of researchers who would work collectively to come to a consensus on the personality of a single person. Similarly, Saul Rosenzweig thought that Allport's idiographic description did not go far enough to explain dynamics within a person, as it did not systematically describe the experiences that might give rise to such variability (Rosenzweig, 1956). He thus introduced the idea of an *idioverse*, which describes the set of events that are unique to a person, and set forth to understand a person's *idiodynamics*, the term he preferred to use to highlight the unique variability within a person. Mirroring discussions that will come below, his theory anticipated the need to more systematically describe the processes that give rise to within-person variability.

The Person-Situation Debate

The bifurcation between the two goals of personality science (nomothetic and idiographic) remained loosely entangled until the publication of Walter Mischel's (1968) *Personality and Assessment*, which sparked the rise of what has become known as the Person-Situation Debate. In his book, Mischel (1968) argued for the importance of situations in understanding and predicting human behavior, highlighting the variability in behavior across situations. A central component of his argument stemmed from what he called the "personality coefficient" of .3, or the limit of the relationship between personality and behavior. If personality traits did not predict *behavior* that well, the argument went, then the variability of behavior across situations must be due to other factors, such as context. Ultimately, the Person-Situation Debate led many people to discount the utility of personality traits, as they appeared to fail to account for the rich variability in behavior within personality.

Personality and Assessment used a number of studies to make the case that variability in behavior was high, bordering on levels large enough that they made traits ineffective for scientific study. In the 1920s, Hartshorne and May (1928) embarked on a series of studies in which they investigated both temporal stability and cross-situational consistency in behavior. In a population of elementary school students, they tested cheating behaviors across time and situations. Within a given context (e.g., an athletic test, spelling test), temporal consistency was quite high, with correlations ranging between .6 and .8. However, across contexts, cross-situational consistency was low, with correlations ranging between .1 and .3. They further investigated the limit of what defined a context, finding that even such simple changes as altering how students marked their answers was enough to alter individual and group levels of cheating.

When one examines Mischel's critique of personality traits, it becomes clear that his ultimate motivation was convincing his readers of the importance of investigating the sources of within-person variability. Although within-person variability was not routinely examined by psychologists at the time, the search for consistency within and across situations could be rephrased as interest in the factors that influence within-person variability. First, for example, Mischel argued that problem with traits was that the existent evidence did not support a conceptualization of traits as stable, environment-independent entities. Instead, behavior was dependent on situations; it seemed to vary as a function of both person and situation. In other words, within-person variability was a critical outcome to be examined and explained. Second, the crucial importance of within-person variability was reflected in the so-called consistency paradox (Mischel, 1968). Although most people report stability in self and experience, one finds considerable variability in their actual behavior that is seemingly influenced more by situations than person-level characteristics. In other words, despite observations of temporal (longitudinal) stability, people showed little short-term consistency.

While *Personality and Assessment* put variability in personality manifestations at the forefront of everyone's mind, discussions of whether personality evidenced cross-situational consistency began decades before the publication of *Personality and Assessment* (e.g., Hartshorne & May, 1928). Moreover, the Allportian definition of traits stands up to many of Mischel's critiques. The early Allportian conceptualization of dispositional traits suggests that they should be consistent (1) in different situations (cross-situational consistency) and (2) in the same situations over time (temporal stability). Allport (1937; 1961) clearly communicated that the threshold of trait "consistency" was arbitrary and depended on the trait in question. Moreover, Allport argued that a trait that did not vary across time or situations (i.e., did not show

“plasticity”; Allport, 1937) was neither useful or meaningful. However, Allportian personality theory was focused on the consistency of traits, allowing for variability, while the Mischelian conceptualization was focused on variability and skeptical of the utility (and necessity) of traits.

Despite the fact that the Person-Situation Debate made variability a key question, consistency, not variability, remained the focus. To demonstrate the utility of traits, research in personality shifted toward delineating the circumstances under which personality was stable and consistent by (1) investigating which person-level characteristics relate to consistency and by (2) shoring up the measurement of personality. These studies were made under the assumption that people do have consistent components to their personality, in the Allportian sense, and that traits should be continued to be incorporated in theories of personality.

First, for example, Bem and Allen (1974) argued that within-person variability must be small if a trait dimension is to be meaningfully interpreted. Thus, given that many people tended to believe they showed cross-situational consistency, Bem and Allen (1974) set out to look for ways to identify those who were consistent or not. In other words, they treated consistency as an individual characteristic in its own right. To assess consistency, participants rated their level and variability on a number of traits, as well as ratings of those traits in specific contexts. Within-person standard deviations of ratings of the same trait in different contexts were associated with self-reported variability in that trait, indicating that it was possible to a priori identify individuals who were consistent. To Bem and Allen (1974), these results indicated that traits seem to predict “some people some of the time” (p. 517), but, in line with Mischel (1973), that does not indicate that an individual is unpredictable. Rather, more inconsistent individuals may simply be more influenced by situational contingencies. In other words, traits exist but must be considered in the context of individual differences in consistency (within-person variability) to be interpreted

meaningfully. However, Mischel & Peake (1982), Chaplin and Goldberg (1984) and Mischel and Shoda (1995) failed to replicate the results of Bem and Allen (1974). Although Chaplin and Goldberg (1984) argued that consistency should be added to a list of failed moderators of the relationship between personality and behavior, Mischel and Shoda (1995) demonstrated that perceived consistency was related to the consistency of patterns of responses *within* contexts.

Second, the concern over consistency and stability was reflected in increasing discussions of reliability and validity in the measurement of personality. Epstein (1979b) argued that while concurrent and predictive reliability were often discussed in personality and social psychology, temporal reliability was often ignored. This is especially problematic as single behaviors were commonly used in studies of cross-situational consistency. Single behaviors, much like single items, tend to have more random error variance in them than composites of multiple items. In many ways, his work echoes Cattell's (1947) writings on the data box, emphasizing that meaningful interpretations of any dimensions rely on assumptions and understandings of the other dimensions. Epstein (1980) demonstrated that when daily measures of (1) self-reports, (2) observer reports, (3) objective events, and (4) behavior are aggregated over time (the occasion (T) dimension of the data box), the reliability estimates of the measures improve dramatically and can be used to reliably predict behavior. Epstein (1980, 1983) went on to clarify four types of aggregation in psychology to improve the reliability of measures, including averaging over (1) people, (2) situations / stimuli, (3) occasions / trials, and (4) measures. In each case, basic observations in the study of internal consistency indicate that aggregation should reduce measurement error, and thus increase temporal consistency.

For example, in one study, each day for one month, participants self-reported their most pleasant and unpleasant experiences of the day then responded to a 90-item adjective checklist of

emotions and a 60-item behavioral checklist indicating whether a specific behavior was carried out (Epstein, 1979). Average reliability estimates for odd versus even days was .88 for emotions, on average, but only .34 and .36 for first versus second and next-to last versus last days, respectively. Similarly, for behavior, odd versus even reliability (.74) far exceeded first versus second (.06) and next to last versus last (.28) reliability. If situations were expected to explain the variability in behavior over time, as Mischel argued, then the reliability of estimates based on multiple observations should have been no different than any pair of selected observations.

Although both Epstein (1979b, 1980, 1983) and Bem (1974) acknowledged the importance of within-person variability, their goal was to explain away such variability (or account for it) to reveal consistency and stability, on average. In short, to save the concept of personality traits. Indeed, Epstein (1983) argued that state measures of a construct were problematic because they were (1) confounded with trait measures, (2) have measurement variance relative to trait measures, and (3) have more measurement error than aggregated measures. Notably, the focus was to use variability to get a more stable estimate of a trait, not to examine variability in its own right.

Despite the measured response, the Person-Situation Debate deepened the divide between the two sciences of personality – one that emphasized variance between people and one that emphasized variance within them. Moreover, the Person-Situation Debate had major ramifications for the field of personality that influenced progress on the study of within-person variability. A large faction of critics of personality sprouted up, going so far as to say that traits were not useful constructs and that the study of personality should instead be the study of important situations. Somewhat ironically, those that eschewed personality and favored a contextualist approach did not provide much information about within-person variability, instead

focusing their efforts on between person lab-based paradigms that demonstrated that people *could* vary in their behavior. However, these lab-based paradigms did not inform the ecological validity, time course, individual differences in, or magnitude of behavior, among other important factors that influenced within-person variability.

Social Cognitive Approaches to Personality

Out of this increased interest in the consistency of personality across contexts and time grew a new theoretical branch of personality – social cognitive theories (or cognitive social learning theories; Mischel, 1973). Social cognitive theories turned traditional methods for understanding cross-situational consistency in personality on their heads by assuming that there was little reason to believe that personality would ever be consistent across contexts or situations. Instead, individual differences were thought to be expressed in the profile of responses in different contexts. That is, some people tended to be outgoing in a particular context, but not another. Rather than define personality from a nomothetic trait perspective using an average (expected) response collapsed across contexts, personality viewed from a social cognitive perspective was the average response within a context. Such within-situation consistency was thought to demonstrate temporal stability, as well. What constituted a context was also an important component of discussion.

A central theory was Bandura's Social Cognitive Theory (Bandura, 1999). Bandura emphasized that individuals are active organisms in their environments, who can choose certain responses in order to get certain results. A key component of this theory is the focus on bidirectional relationships between person and environment, which emphasizes the variability within a person's behavior. Depending on one's motivations, people could behave differently in the same situation. For example, one's behavior with the same friend would differ greatly when

one is trying to convince the other of something than it would on average across a number of different motivational contexts. Bandura (1999) broke the person-situation interplay into three components – person-level states (cognitive, affective, and biological), behavioral patterns (more akin to traits), and environmental events. How someone behaved depended on these three components and, importantly, all of the components bi-directionally influenced one another. Unlike traditional trait perspectives, which put the person first, his view gave equal weight to state, person, and environmental components. Moreover, he emphasized that objective features of imposed and selected environments are not equal to the subjective constructed environment. That is, the experience of an environment may be quite different from the objective features that make it up, and this may vary across person and across time.

Social Cognitive Theory was built on the foundational work on self-efficacy, which he defined as “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 3). Bandura argues that it makes little sense to construct general measures of self-efficacy as some constructed items may have little to no relevance for a given person in a given domain (Bandura, 2006). Instead, measures of self-efficacy (and by extension other psychological constructs) should be constructed for specific contexts or domains of interest. Constructing domain-specific measures of self-efficacy has the added benefit, then, of identifying which features are relevant or not across different types of contexts. This advance led to a proliferation of self-efficacy measures, which have oft been used to predict domain specific outcomes at levels above personality traits (Bandura, 1983; Judge, Jackson, Shaw, Scott, & Rich, 2007).

While the creation of contextualized and domain specific measures is one potential response to capturing the variability inherent in personality, it is worth considering two key

considerations. First, contextualizing measures have been touted to lead to increased predictive validity (via the bandwidth-fidelity tradeoff). However, it is important to consider the greater likelihood of content overlap between predictor and outcome, especially for a construct such as self-efficacy (Jackson, Hill & Roberts, 2012). Second, it is worth asking whether the domain specific measures are domain specific or reflect more global functioning. Evidence from personality (Wood & Roberts, 2006), attachment (Sibley & Overall, 2008) and self-efficacy (Jackson, Hill & Roberts, 2012) suggest the existence of a global factor. These findings indicate while there are domain or context specific variance, across these domains there are shared commonalities.

Another related branch of social cognitive approaches accounts for variability across contexts by borrowing from stimulus-response learning models (Wright & Mischel, 1987). Termed “conditional approaches” to personality, these focused on *if...then* patterns of relationships that can vary across contexts and people (i.e., *person-situation transactions*). From this perspective, personality should be conceived in probabilistic relationships – the probability of certain response tendencies or behaviors $p(B)$, the probability of certain conditions or contexts $p(C)$, and the conditional probability of a certain response tendency or behavior in a certain condition or context $p(B|C)$. They argue that personality researchers tended to focus just on the constant aspect of behavior where traits can be thought of as the $p(B)$ component, neglecting the other components.

Conceiving of personality in the context of these probabilistic relationships emphasizes several key points. First, dispositions $p(B)$ mask important between- and within-person variability. Second, it is possible to conceive of both between- and within-person variability as conditional probabilities. In other words, one can take advantage of probability theory to

understand how the relationship between person and environment influence behavior between people on average and within-person over time. Third, contextual models incorporate base rates, or the prior probability that someone will be in a particular context $p(C)$, which is an important source of variability in behavior. Indeed, the probability of encountering specific contexts $p(C)$ is an important but largely unexplored individual difference that we will consider in more depth in the section on situations.

Despite the promise of conditional approaches for reconceptualizing the study of personality and situations, it was limited by the statistical methods available to test it. For example, in a seminal series of studies, children being treated for behavioral disorders at the Wediko Summer Program in New Hampshire were observed by multiple individuals who rated them on a number of dimensions across different contexts (e.g., Mischel & Shoda, 1995; Shoda, Mischel, & Wright., 1994; Wright & Mischel, 1987). These studies demonstrated that children who exhibited similar mean levels of aggressive behaviors frequently had meaningfully different patterns of psychological precursors, such that some children were aggressive when threatened by peers but not when confronted by authoritative adults, while others showed the opposite pattern (Wright & Mischel, 1987). Although the initial studies of *if...then* contingencies utilized paradigm-shifting data collection methods (extensive repeated assessments by observers at a summer camp), the statistical models of the time were not able to probabilistically model the contingencies, a question we will return to in the section on the future of personality measurement and modeling.

Mischel and Shoda's (1995) Cognitive Affective Processing System expanded on conditional approaches to personality by focusing on the psychological features of contexts (e.g., felt threatened), rather the objective features (e.g., social situation with peers). These

psychological features activate what they term *cognitive affective processing units*, which include encodings, expectancies and beliefs, affect, goals and values, and competencies. Different cognitive-affective units are not independent but dynamically influence and interact with one another.

The CAPS model has several distinguishing features. First, by incorporating both psychological features of situations and cognitive-affective units into predictions of behavioral outputs, the CAPS model accounts for different precursors of the same behavior. Second, the CAPS model explicitly accounts for different sources of variability, some of which is captured by variability in situations that influence variability in cognitive affective processing units that bi-directionally influence one another. Third, the CAPS model provides an alternative way to conceptualize of the structure of within-person variability. Rather than using a P-technique factor model to reduce within-person variability to a set of relative unique traits, one could attempt to model the dynamic relationships among those indicators. P-technique and related methodologies do not have the capability to account for changing dynamics between situation and cognition when, say, affect differs.

Fourth, the CAPS model explicitly introduces behavior into the model of personality. In other words, rather than examining variability in composites of trait manifestations over time or contexts, the CAPS model directly addresses how situation features and relationships among cognitive affective units influence directly observable behavioral outputs. Finally, the CAPS model highlights different levels of individual differences within a person. People can differ in the psychological features of situations, how those features relate to and activate cognitive affective units, and how those cognitive affective units influence behavioral outputs. Because of the multitude of ways that individuals can and do differ and the cascading effects of those

differences at different levels, it ultimately makes little sense to build a science of personality based at the level of a group or population. Instead, the CAPS model highlights the importance of understanding and modeling a person in their own unique (idiographic) complexity and outlines locations to search for the key variables that will help to elucidate those differences. In other words, the CAPS model's levels of individual differences highlight the need to consider personality idiographically. The underlying structure of individuals' personalities are likely to be nearly incomparable across people.

Given these vast number of individual differences at the person level, the CAPS model has important disadvantages that have prevented systematic tests of its implementation and predictions. Some of these are practical. To investigate the dynamic relationships among cognitive affective units requires intensive time series data (with many occasions (T) and variables (X) from Cattell's data box). Moreover, how to define those cognitive-affective units and how often to measure them remain substantive questions. Other disadvantages are more fundamental. It is, for example, still an open question as to how to define the psychological features of situations (although see Rauthmann et al., 2014; Parrigon, Woo, Tay, & Wang, 2017, for exceptions). It is also unclear how to adequately capture fine-grained measures, like encoding processes, in the naturalistic settings fundamental to personality assessment and modeling. Thus, the CAPS model is ultimately an important theoretical tool for thinking about personality and individual differences, but the complexity of its implications still renders it mostly untestable.

Social cognitive approaches represent important advances in the study of personality broadly and within-person variability in personality more narrowly. The Person-Situation Debate prompted personality psychologists to focus in on the search for cross-situational consistency and temporal stability where cross-situational inconsistency was seen as measurement error. But

social cognitive approaches shifted the focus, making (in)consistency (within-person variability) a key outcome variable to be explained. Moreover, it drew attention to the fact that variability itself, often represented as profiles of responses in different contexts, was an individual differences characteristic worthy of systematic study.

Trait approaches to Individual Differences

In the latter half of the 20th century, identifying the structure of between-person differences became paramount. While the temporal stability of personality has been a question of interest since before Allport, the fallout of the Person-Situation Debate focused efforts on looking at the consistency of personality. Settling on a common personality structure was a critical development, as it allowed personality scientists to accumulate advances concerning the development of personality. As a response to the idea that traits showed too much variability to be meaningful, many longitudinal studies were carried out that showed the stability of personality across decades. Differential consistency, often measured as test-retest consistency, remains strong even over more than 30 years (Damian, Spengler, Sutu, & Roberts, 2018, Fraley & Roberts, 2005, Hampson & Goldberg, 2006; Brent's). These findings occur across different raters (Block, 1983) and at different times in the lifespan (Roberts, Walton, & Viechtbauer, 2006), indicating that personality traits were not so variable as to be meaningless (Kenrick & Funder, 1988). When looked at the individual-level via profiles of personality, measures of ipsative (profile) consistency also suggest high levels of temporal consistency (Donnellan, Conger, & Burzette, 2007; Roberts, Caspi, & Moffitt, 2001).

Such evidence on the consistency of personality traits has made these between-person traits indispensable within the field of personality. Despite evidence of variability across situations, stability across large temporal periods is quite high. It is this stable component of

personality that is likely responsible for many of the relationships between personality and important life outcomes (Hampson, 2012; Hill & Jackson, 2016). However, work on personality stability has also highlighted the importance of considering within-person structure and variability. For example, although ipsative consistency is, on average, quite high, it also shows considerable individual differences, such that some people are quite consistent while others seem almost nothing like their previous selves (c.f. Beck & Jackson, 2019). Similarly, in terms of absolute change, while there are normative patterns of change across the course of development (e.g., Roberts et al., 2006), there are also individual differences in change (e.g., Mroczek & Spiro, 2003). These findings indicate that, as with Allport's (1937) contention that to understand personality you need to look at the level of an individual, understanding the temporal consistency of personality is also an individual-level endeavor.

Moving Toward a Science of Within-Person Variability

“To serve as a successful modus vivendi a trait must remain plastic or lose its usefulness”

(Allport, 1937, p. 332).

Despite considerable progress within personality in the 20th century, the rift between the two sciences of personality had yet to be mended. In the late 20th century, personality theorists planted seeds that held promise for the integration of idiographic and between-person personality by incorporating within-person variability to improve the measurement of personality. However, in most cases, variability was not considered important or interesting in its own right. But work by Craik (2000) at the turn of the century highlighted how variability may play an informative role in the study of personality. Using lived day analysis, Craik investigated how individuals experienced their days in the context of their real lives, arguing that such an approach allowed the researcher to examine “behavior setting concepts, goal-oriented concepts, and trait concepts”

(Craik, 2000, p. 242). Essentially, by following a participant for an entire day and continuously recording, either using recorded video or written depictions of in vivo observations, lived day analysis seeks to capture how an individual goes about their daily lives and to use this to understand that person. The goal of this approach was not to aggregate across events of the day, but to understand them in context. In other words, variability was signal, not noise.

Indeed, at the turn of the century, within-person variability began to work its way into a number of theories of personality that were not rooted in the social cognitive theory. In 2001, Fleenon extended Zuckerman's (1979) and Buss & Craik's (1980) contention that personality traits were aggregates of states. Although Fleenon (2001) concurred that the means of distributions states reflect traits, he further argued that states and traits could be linked by investigating other parameters of distributions of states.¹ The peak of the distribution represented the average state (or trait) levels of a specific characteristic. But density distributions also have other characteristics, such as dispersion (e.g., range and standard deviation of states), skew, and kurtosis, all of which provide information above and beyond mean levels alone. The importance of conceptualizing personality as a density distribution cannot be overstated. In doing so, variability moved from being useful for determining stable estimates of traits to being a focal point itself, opening up a wealth of new questions and turning personality researchers to a new century of study.

Work on linking state and trait assessments through density distributions was supported by new data collection techniques. Indeed, arguably no method was more important for

¹ The idea that mean-levels and variability of personality were connected was not new. Cattell (1957) wrote extensively on the topic of variability and the need to assess the relationship between personality "levels" and variability, but because there were several structural theories of personality (including Cattell's 16 factor solution; Cattell, Eber, & Tatsuoka, 1970), none of which were dominant or involved the large-scale data collection of states that the Big 5 have garnered in the last 20 years, such questions were almost completely unexplored.

advancing the study of within-person variability than the rise of the Experience Sampling Method (ESM; Larson & Csikszentmihalyi, 1983). ESM data, which can be called multivariate time series data or intensive repeated measures, among other names, include a set of variables from a single individual multiple times within or across days or weeks. While data such as these have been collected since the 1940s or earlier (e.g., Cattell, 1947), there was no coherent framework on how to assess personality and such data were not routinely collected until the introduction of electronic assistants that help “ping” participants throughout the day. The tools of ESM have progressed since its introduction, shifting from beepers to palm pilots, and then from palm pilots to iPods and smart phones as personal devices became ubiquitous. The collection of such data opened up new opportunities for assessing all the dimensions of Cattell’s data box – that is, by making it easier to collect multiple observations (T) from different individuals (P) across sets of variables (X), researchers could tackle questions that had previously been difficult. Previously, most questions had focused on Person (P) \times Variable (X) questions, fixing (or averaging across) the observations (T). Now, though, researchers turned to tackling Person (P) \times Observation (T) questions, fixing the Variable (X). Such questions included investigating between versus within-person sources of variability in personality (e.g., Fleeson, 2001; Fleeson & Gallagher, 2009; Sherman, Rauthmann, Brown, Serfass, & Jones, 2015) and carryover-effects of personality states (autocorrelative relationships; Beck & Jackson, 2019).

However, the increasing prevalence of the study of Person (P) \times Variable (X) relationships was not only supported by the rise of new data collection techniques. Indeed, intensive repeated measures offered a methodological challenge to traditional regression-based techniques for analyzing data because of the violation of the independence of errors assumption in regression. When there are multiple measures from the same individual, errors across

observations within a person are correlated (e.g., Bolger & Laurenceau, 2013; Raudenbush, 2002). In the late 20th century, new regression-based techniques for dealing with such data were developed to deal with cases of non-independence of errors. Called *multi-level modeling* (MLM; also called hierarchical linear modeling, HLM, and mixed effects modeling), such techniques account for a nested structure within the data (e.g., Fleeson, 2007; Robins, Tracy, & Sherman, 2009). In the study of within-person variability, this means that occasions are nested within-person.

MLM not only accounts for variability across persons and observations, it also explicitly models these sources of variability and can also incorporate contexts / situations into the models. As such, some have argued that MLM helps to bridge the gap between nomothetic assessments of personality that focus on between-person differences and idiographic assessments of personality that focus on within-person variability (e.g., Conner, Tennen, Fleeson, & Barrett, 2009). Although it is worth noting that MLM is *not* idiographic because individual-level estimates are informed by and *shrunk* toward group-level averages, it has given researchers a framework for answering questions about temporal (both sequenced and unsequenced) aspects of personality including (1) average mean-level estimates of within-person variability in personality states, (2) average short-term time effects of the same variable measured at two different points in time (i.e., autoregressive relationships), and (3) average relationships between two different variables measured at the same time point (i.e., contemporaneous relationships). ²

Within-Person Variability Conceptualizations

² Our discussion of these models is not meant to be exhaustive. There are important practical details we will not discuss or not give proper consideration. We refer readers elsewhere for details on estimating these models (e.g., Bolger & Laurenceau, 2013; Conner et al., 2009; Piccirillo, Beck, & Rodebaugh, 2019; Robins et al., 2009).

One critique of the tension between nomothetic and idiographic approaches to assessing and modeling personality involves parsing apart between-person differences, within-person differences, and measurement error. Cattell (1957) wrote on the topic elegantly, further breaking down within-person variability into *oscillations* (momentary changes) and *fluctuations* (changes over longer time periods, like days or weeks). Moreover, he argued that it is important to understand the relationship “between the level on a single variable and its tendency to vary” (Cattell, 1957, p. 595). Although the term within-person variability has come to stand for many approaches related to repeated measures of an individual over time, the true definition of within-person variability is the statistically stable estimates of unsequenced variability (i.e., standard deviation) of an indicator.

Recently, ESM has made answering questions about within-person variability possible. For example, Fleeson (2001) examined the relative variability of the Big 5 within-person and between people, finding that within-person variance (measured as within-person standard deviations of personality states) was larger than between person variability of personality traits and averages of personality states for Extraversion and Conscientiousness. Importantly, this also indicates that despite average levels of personality, people tend to use the full range of the scales. Moreover, there were cross-domain differences in average within-person variability, with Extraversion being the most variable domain and Agreeableness being the least variable domain. Other investigations have found similar results (e.g., Sherman et al., 2015; Horstmann, Rauthmann, Sherman, & Ziegler, 2018). Variability in personality states have also been used to help understand the relationship between affect and personality, finding that Neuroticism is related to negative affect variability (e.g., Bringmann et al., 2016) and Extraversion is related to

positive affect variability (e.g., Kuppens, van Mechelen, Nezlek, Dossche, & Timmermans, 2007).

Moreover, within-person variability is a valid individual difference measure that provides information above and beyond mean-level trait scores (Fleeson, 2001). Although other parameters of density distributions, such as the within-person standard deviation, minimum, maximum, skew, and kurtosis tend to be related to nomothetically assessed personality measures, these measures also tend to be confounded with the mean of a density distribution (Fleeson & Gallagher, 2009; Jones, Brown, Serfass, & Sherman, 2016). Indeed, when controlling for the mean of the density distribution, relationships between these measures of density distributions of personality states and nomothetic personality measures largely disappeared, with two notable exceptions (Jones et al., 2016). Extraversion and Emotional Stability trait levels predicted standard deviations and other density distribution parameters of multiple personality states, behaviors, and situation characteristics. The relationship between Emotional Stability and density distribution parameters highlights the importance of examining within-person variability – the very definition of Emotional Stability predicts that it should be related to variability.

Although the existent research highlights the importance of within-person variability, defined as unsequenced deviations from average levels (within-person standard deviations), researchers should be careful when operationally defining variability. In many instances, the true definition of within-person variability may not be the optimal definition. Instead, temporally sequenced patterns may be more apt, for example in understanding how feelings of depression are maintained over time. In such cases, other time-series metrics, like autocorrelations, may be more informative. In sum, considering how traits or outcomes should be related to time series metrics should be sensitive to the questions of interest and not simply apply within-person

variability as a “one size fits all” answer. In the rest of this paper, we will consider other ways of operationalizing these metrics to answer different types of questions raised in the larger within-person variability literature.

Temporal Variability

Although investigations of within- and between-person variability were important for shifting the focus of some personality researchers to within-person variability, they do not directly capture Cattell’s concept of oscillations or fluctuations. However, by incorporating the statistical concept of a lag into a model, one can model average fluctuations or oscillations of a variable over time. Essentially, a lag means shifting observations of measured variable (X_t) one time point (X_{t-1}) and then regressing the lagged variable (X_{t-1}) on X_t in what is called *autoregression* (or *autocorrelation* in the case of simple bivariate correlations). The resulting coefficient captures “carry-over” effects of the measured variable. So, for example, Neuroticism shows strong autoregressive effects, suggesting that previous Neuroticism (X_{t-1}) predicts current Neuroticism (X_t ; Beck & Jackson, 2019). This addresses the question of whether behavior in one situation is related to behavior in another at later in time. Despite the promise of using lags to understand patterns of personality over time, to our knowledge, almost no research has examined lagged personality states over time (see Beck & Jackson, 2019 for an exception).

However, we are not always interested in simple fluctuations or oscillations of a single variable. Often, we are interested in approximating how something measured at one point influences something that happens later, such as current Extraversion and Conscientiousness predicting both future boosts in positive affect as well as fatigue (Leikas & Ilmarinen, 2017). In such cases, one can investigate *cross-lagged autoregressive* effects, in which one lagged variable ($X_{1,t-1}$) is regressed on another variable ($X_{2,t}$), which tests whether a previous personality state

predicts a second state at the present moment. For example, in one demonstration of the relationship between personality manifestations and physical exercise, previous time point energy and guilt were positive predictors of physical exercise (Epskamp, Waldorp, Möttus, & Borsboom, 2018). Moreover, previous time point exercise predicted lower current levels of energy, suggesting a cyclical compensatory link between energy and exercise, which may partially explain consistent links between trait Extraversion and physical activity – higher levels of energy, both within and between people, are generally associated with higher levels of exercise.

Despite the promise of lagged models, there are number of reasons to be cautious in their interpretation. First, imagine you are assessing a psychological state that changes very rapidly, like anger, a facet of Neuroticism, as well a psychological state that changes more slowly, like worry, another facet of Neuroticism. Many ESM studies use time lags between 3 and 6 hours, meaning that if these states are changing more rapidly than this, their autoregressive relationship would be 0. However, this would not be because there is no autoregressive relationship but because there is no autoregressive relationship *at this time interval*. Second, imagine a (likely unavoidable) case where you have ESM data with measurements that are unequally spaced. If you would simply lag that variable, then the lagged relationship would correspond to different time scales. Thus, even if the variable is captured at the proper time lag, the lagged relationship could be masked (either exaggerated or attenuated) by these improper lags. Finally, there appears to be little within-person consistency of lagged relationships among personality states (Beck & Jackson, 2019). For example, in one study, participants completed two rounds of ESM measures of personality one year apart (Beck & Jackson, 2019). Cross-lagged models of associations between personality states showed almost no ipsative consistency of cross-lagged associations on

average although some individuals exhibited relatively strong ipsative consistency. For this reason, we caution personality researchers to be wary of over-interpreting lagged effects and encourage them to also consider within-person contemporaneous (non-lagged) relationships.

Encouragingly, psychologists are also often interested in the relationships between variables measured at the same time (contemporaneous relationships). In the study of emotion, for example, concurrent measures of positive and negative emotion have revealed individual differences in the direction and magnitude of the relationship between positive and negative emotion that were independent of trait measures of Neuroticism and Extraversion (Rafaeli, Rogers, & Revelle, 2007), which are consistently associated with average state levels of positive and negative affect. The relationships between manifestations of personality states measured concurrently help to delineate how personality functions in the moment because, as Allport (1937) wrote, “No trait operates alone” (p. 330). Despite this, no work, to our knowledge, has investigated how the relationship between co-occurring personality states predicts outcomes. However, understanding how traits operate together are critical in understanding behavioral outcomes. For example, high state levels of concurrent sociability (E) and ideation (O) may lead to someone to be discuss ideas with others, while low sociability (E) coupled with high ideation (O) may lead to more isolated forms of idea formation. Critically, although such links may be dispositional, with a given individual more likely to show one link than another, these links are likely to vary through time and may explain behavioral shifts.

Person × Situation Transactions Revisited

Since the search for cross-situational consistency began, personality psychologists have invested in defining and understanding situations. Many recognized that situations were important in determining behavior, but there was little consensus on how to measure situations.

Lewin (1951), for example, argued that behavior is a function of both current person and environment variables, or $B = f(P,E)$ and $B = f(S)$ where behavior is a function of the psychological situation. In the language of within-person variability, therefore, situations are critical for understanding within-person variability. However, person variables are much better defined than situation variables, making the technical breakdown and differentiation of situations critical to understanding how person and situation variables influence variability in behavior.

In recent years, there have been important efforts to establish a taxonomy of situations, both using Q-sort data from the Riverside Situational Q-sort (RSQ; Wagerman & Funder, 2006) – the DIAMONDS (Rauthmann et al., 2014) – and a lexical technique based on characteristics of situations – CAPTION (Parrigon et al., 2017). The DIAMONDS, in particular, have been applied in a number of studies to examine person, situation, and person \times situation effects of state-level manifestations of personality and behavior (e.g., Sherman et al., 2015; Horstmann et al., 2018; Jones et al., 2016).

Such investigations, have found that personality and situation variability, both between and within-person, have additive effects (i.e., main effects), not multiplicative effects (i.e., $P \times S$ interactions), on state personality manifestations (Sherman et al., 2015; Horstmann et al., 2018). Since the early days of research trying to understand how personality and situations jointly influence behavior, researchers have approached such questions as so-called statistical person \times situation interactions. These interactions are symmetrical – that is, they can be interpreted as “personality’s influence on behavior varies as a function of situations” or as “a situation’s influence on behavior varies as a function of personality.” As described previously, one way of attempting to understand person \times situation interactions is by examining the *if...then* contingencies that underlie social cognitive theories of personality (e.g., Wright & Mischel,

1987). In such cases, people are asked how they generally respond to situations of a specific kind and about their personality characteristics or behavior are measured situations measured as binary (in a situation or not). However, by using continuous measures of psychological characteristics of a situation, one can assess how psychological perceptions of situations may influence behavior. For example, Sherman and colleagues (2015) tested how differences in momentary measures of situations across levels of personality predicted state manifestations of personality. They found that personality traits and situations were reliable predictors of state manifestations separately but that situations across levels of personality traits were not better predictors of state manifestations of personality above and beyond their unique influences.

Despite aggregate evidence that person \times situation interactions do not out-predict either personality or situations alone in predicting behavior, we believe that this highlights an important limitation in using such aggregate techniques. Although personality and situations do explain a considerable proportion of the variance in behavior, there are still considerable individual differences in both level and slopes, which suggests that there unexplained individual-level variance in behavior (Fleeson, 2001; Sherman et al., 2015; Horstmann et al., 2018). From an Allportian perspective, this is not surprising – adopting a common-trait perspective necessitates added error in measuring and understanding both personality and situations. Thus, rather than adopting a between-person perspective and searching for aggregate patterns of person \times situation interactions predicting behavior, adopting an idiographic framework may better capture how person \times situation interactions operate within a person, an idea we will return to in the section below.

Bridging within- and between-person processes

Despite the promises of using ESM and MLM to investigate “within-person processes,” several researchers have elegantly laid out evidence suggesting that using between-person models, like factor analysis and MLM, to investigate within-person processes, is often misleading and does not allow for strong interpretations (Borsboom, Mellenbergh, & Van Heerden, 2003; Molenaar, 2004; Fisher, Medaglia, & Jeronimus, 2018). However, establishing the connection between the two sciences of personality (idiographic and nomothetic) is key if we (1) wish to make inferences about one level using the other or (2) want to determine the best level of analysis for a specific question. Both Allport (1937; 1961) and Cattell (1947; 1957) were careful to point out that there was little reason to think that these two approaches would yield the same results when conducting P- or R-technique factor analysis. But whether this is ever the case is both a theoretical and empirical question that went unanswered until the 21st century. Evidence of the lack of correspondence between between- and within-person personality structure has come in form of mathematical (Molenaar, 2004), statistical (Borsboom et al., 2003), and empirical (Fisher et al., 2018) evidence.

Mathematically, if within-and between-person processes were equivalent, they would be *ergodic* (Molenaar, 2004). In psychology, this would mean that there would be equivalence between P-technique factor analyses of multivariate time series data ($X \times T$, fixing P) and R-technique factor analyses of multivariate data ($X \times P$, fixing T). Since manifest variables are generally Gaussian processes, the requirements for demonstrating whether between and within-person processes are equivalent is quite straightforward, but multivariate time series of psychological indicators do not meet them. Indeed, in a recent demonstration, Fisher et al. (2018) investigated the equivalence of within-and between-person means and standard deviations, finding that the distributions were quite different, which indicates that the time series are non-

ergodic and individual-level estimates cannot be made from between-person estimates.³ Such an observation is not to be taken lightly, as it suggests that inferences based on between-person models may be misleading at best and wholly incorrect at worst, which seriously threatens the scientific process.

How strong the mismatch between within- and between-person models is likely due to differences in materials, procedure, and sampling. Across studies that have examined the question, the mismatch exists (e.g., Beck & Jackson, 2019; Borkenau & Ostendorp, 1998; Borsboom et al., 2003; Fisher et al., 2018; Molenaar, 2004), which, at best indicates that inferences based on between-person models in psychology will be imprecise, and at worst could completely undercut the validity of key theories and models (Fisher et al., 2018).

Although Allport (1937) both anticipated these concerns in the early 20th century and advocated for within-person studies of personality as a solution, it has taken nearly a century for these concerns to return to the fore in personality (see Beck & Jackson, in press). Now, the Allportian call for more idiographic approaches to personality assessment and theory appears prescient and offers a pathway forward. If mismatch between idiographic and nomothetic models is strong, as it often is in psychology, then psychologists must turn their attention back to testing idiographic questions posed by Allport and others almost a century ago. Recently, for example, Beck and Jackson (2019) examined the congruence between idiographic and between-person personality structure using well-known (if not oft applied) techniques, like P-factor analysis, as well newer models that account for timing effects. In total, they examined idiographic between-person congruence for six classes of models (e.g., cross-lagged autoregressions and unified SEM,

³ For a more thorough discussion, we refer reader to read Borsboom et al. (2003), Molenaar (2004), and Fisher et al. (2018) in detail as they make important points on what considerations and preliminary tests should be conducted on multivariate time series data before conducting descriptive and inferential tests.

see below). Across each method, they found little congruence between the between-person reference structure and idiographic structures, with some people showing strong congruence but many showing weak congruence at best. Although much work is needed within personality to better understand the correspondence between within- and between-person models of personality structure and how variability can be leveraged to improve our understanding, this study represents the most comprehensive study to date examining methods for assessing congruence. The lack of evidence for such congruence is striking and further highlights the need for devoting more attention to idiographic assessment and modeling.

In sum, the introduction of ESM greatly influenced research in personality in the 21st century, shifting it from an almost exclusive focus on nomothetic measures of personality to a focus on variability and conceptualizing personality as density distributions of states. Moreover, ESM has allowed researchers to begin to parse within-person variability that is ecologically assessed into different components, including those that can be explained by situations, and to look at different patterns (Person \times Situation interactions) across different people over contexts and time. Finally, a recurring theme in discussing the limitations of recent approaches to within-person variability highlight that most of the present models are still optimized for making group-level, between person, not within-person, idiographic conclusions. In the final section, we turn to future directions that approach existing questions on within-person variability from a more nuanced, idiographic perspective.

Future Directions

“Novel and somewhat daring methods will be required” (Allport, 1937, p. 20).

The 20th century saw the introduction of personality psychology as well as its refinement. But Allport, Cattell, and others posed a number of key questions that could not be addressed

using data collection and statistical techniques available at the time. Some of these questions (e.g., the correspondence between P-technique and R-technique factor analyses of within- and between-person data) were partially addressed, while others (e.g., the processes and dynamics of personality) remain under-addressed or completely unaddressed. In this section, we reintroduce a number of theoretical questions posed in previous sections and offer a number of relatively new and novel approaches for answering these questions by measuring and modeling *individuals* (i.e., idiographic techniques).

Beyond Variability and Autocorrelations

As detailed in previous sections, Allport (1937) defined personality as “the *dynamic* organization *within the individual* of those psychophysical systems that determine his unique *adjustments* to his environment” (p. 48; emphasis added). Arguably, although P-technique factor analysis captured structure, it did not capture (or intend to capture) the dynamic structure of personality at the level of the individual. Techniques for assessing autocorrelation / autoregression (e.g., Bringmann et al., 2016; Epskamp, Waldorp et al., 2018) and for decomposing variance into between and within-person components (e.g., Fleeson, 2001; Fleeson & Gallagher, 2009; Sherman et al., 2015) were fundamental in increasing interest in within-person variability in personality, but these techniques alone do not capture the dynamic elements of personality. However, by incorporating previous research on autocorrelations of and variability in personality in states with two additional measures – (1) instability and (2) cyclic trends – we can come closer to answering theoretical questions.

First, as Allport argued, personality traits are a “form of readiness for response” (Allport, 1937, p. 293), which is not captured in either variability (within-person standard deviation) or carry-over effects (autocorrelations). Instability, which is often measured using the mean-squared

successive difference (MSSD), captures not just how much a person varies, on average, over time or how consistent their state manifestations are (Ong & Ram, 2017). Instead, instability captures how extreme deviations are when they occur. In other words, when changes tend to be more extreme over time, we partially capture the readiness for response components of personality traits. Indeed, when considering the Big 5 dimension Neuroticism, whose positive pole is Emotional Stability, a measure of instability is a more direct test of the construct than within-person variability or autocorrelations. For example, two individuals could show identical within-person variability (average scaled difference between an observation and the average observation) but very different MSSD's (sum of squared differences between successive observations). If, across 20 observations, one individual gave the same rating (e.g., "1") to the first half of observations and a different rating (e.g., "2") to the second half of observations, while the other individual alternated between the two ratings for the whole period, they would have the same within-person variability ($SD = .51$) but different MSSD's ($MSSD_1 = .05$; $MSSD_2 = 1$).

Second, cyclic trends in psychological states have been largely unaddressed in personality psychology. Despite that, cyclic trends, which could operate on the level of minutes and hours to days and months, can be easily incorporated into the concept of personality as a disposition. Moreover, separating cyclic trends characteristic to an individual from reactivity and autocorrelative effects is important in understanding those effects. For example, there are clear diurnal cycles in energy levels, which is often a measure of the activity level facet of Extraversion, across the day. If cyclic trends are not accounted for, this may mask patterns of variability *within* a day by not accounting for variability across days. In a demonstration of how cyclical trends are critical in understanding the processes that underlie personality, Revelle and

colleagues (1980) examined arousal levels as a function of Extraversion and diurnal cycles, finding that higher levels of arousals among those low in Extraversion occurred only in the morning. Indeed, the cyclic trend itself may be an individual difference characteristic (e.g., the periodicity in arousal may be predictive of both personality traits and outcomes).

Novel Methods

Although P-factor analyses capture the organization of idiographic personality and “dynamic” measures (e.g., autocorrelation, MSSD, cyclic trends) partially capture dynamic aspects of personality, neither technique captures a “dynamic organization” (Allport, 1937). Lagged models in personality help to address questions about both dynamics and structure. As Allport (1937) noted, “No trait operates in isolation,” so it is important to assess how psychological states influence each other within and across time, which, at least as of the writing of this chapter, remains almost completely untested. But the importance of incorporating interactions between traits cannot be overstated. This is also reflected in social cognitive theories, like the CAPS model, which conceptualizes personality as a system of interacting cognitive-affective processes (Mischel & Shoda, 1995). But simple lagged relationships do not capture such cross-lagged, interacting effects that would characterize a system, and it was not until recently that statistical models that could account for a large number of predictors without overfitting were introduced (e.g., Bringmann et al., 2016; Epskamp et al., 2017; Gates & Molenaar, 2012; Zou & Hastie, 2005; Wild et al., 2010). Thus, more robust extensions of the simple lagged model are an important test of questions about the structure and nature of personality.

The first such quantitative model that incorporates lags between variables (or cross-lags) into the autoregressive models already discussed. New techniques for the basic lagged, or vector

autoregressive (VAR) model (e.g., Bringmann et al., 2016; Epskamp et al., 2017; Gates & Molenaar, 2012; Wild et al., 2010), have been proposed and implemented (in a limited manner) to account for (1) bidirectional relationships between lagged predictors, (2) additive relationships among lagged predictors, and (3) the structure of these relationships (Beck & Jackson, 2019). Cross-lagged VAR models have several advantages. First, they account both for within- (contemporaneous) and across- (lagged) time relationships. Second, by including larger set of predictors and using pruning techniques to prevent multicollinearity (e.g., graphical LASSO; Friedman, Hastie, & Tibshirani, 2008), they capture the unique relationships among diverse phenomena that influence manifestations of personality. Third, and most simply, they offer a method for testing complex sets of relationships that are a hallmark of many key models of personality (Allport, 1937; Cervone, 2005; Mischel & Shoda, 1995; 2005). Such relationships are complex not only in that they can include a large number of predictors but also in what those predictors are. For example, within such a framework, one can include state measures of both personality and situations (c.f. Beck & Jackson, 2017 for an example).

Another way of conceptualizing cross-lagged VAR models is in the language of conditional frameworks of personality (Wright & Mischel, 1987). Lagged relationships represent *if...then* contingent relationships, while contemporaneous associations capture *while* relationships. In other words, cross-lagged VAR models allow personality researchers to test for conditional associations that characterize the study of person \times situation interactions but while explicitly modeling those in a framework that also controls for the influence of other psychological variables.

Personality as a Dynamic System

In 1957, Cattell noted the importance of incorporating time effects into models of personality. Similar to his discussion of periodicity and cycles in psychological states, accounting for different time effects is important for creating reliable models from which conclusions can be drawn. Indeed, Cattell (1957) wrote that “the task of research is first to establish statistically and experimentally the nature of the rhythms and then to trace them to internal physiological or external environmental sources, or both” (p. 610).

Timing is an important consideration for both measuring and modeling psychological processes. On the measurement side, if the optimal measurement interval for different processes can be established, then these can be measured more efficiently. For example, if the optimal timing for a process is 4 hours but is generally measured every 2, then this may be over-burdening a participant.

On the modeling side, unequal measurement intervals between lags and missing data are a threat to the validity and reliability of the model. Although there are a number of techniques to deal with this issue, including cubic spline interpolation (Fisher et al., 2017) and multiple imputation (see Piccirillo, Beck & Rodebaugh, 2019 for a more thorough discussion), they do not adequately address the issue that measuring psychological processes at fixed intervals is unlikely to capture the optimal lag between measurements. New techniques, like the continuous time VAR (CVAR; Haan-Rietdijk, Voelkle, Keijsers, & Hamaker, 2017) model, help to correct this issue by treating time more continuously.

Continuous time models have a number of advantages. First, they come closest to how Allport (1937; 1961), Cattell (1947; 1957), Mischel and Shoda (1995), and others conceptualized of processes of personality – as continuous processes whose interaction over time influences an outcome. Second, and more pragmatically, they can deal with unequal lags between

measurement occasions. Even when using a fixed interval design (e.g., responses captured every 4 hours), individuals are unlikely to respond at the precise time they are beeped. In CVAR, assuming time information is collected, the time can be explicitly incorporated into the model to avoid conflating different time intervals as the same. Third, because they incorporate time directly into the model, they can better estimate true autoregressive relationships. Using CVAR, not only is unequal measurement spacing not an issue, it is even desirable. That is, when measures are collected at different intervals, then CVAR and other methods for continuous time modeling allow the researcher to examine the strength of relationships at different time intervals. Thus, one could test, for example, the association between anxiety and depression, two facets of Neuroticism, at one hour, two hour, etc. time lags to see the change in the relationship over time. Establishing the timing of different psychological processes is an important consideration in both the measurement (e.g., how often to matter) and modeling (e.g., the form of the model to use) of personality processes.

The Speed of Psychological Processes

As noted in our discussion of instability, to Allport, personality traits were a “form of readiness for response” (Allport, 1937, p. 293). But instability (operationalized mean square of successive differences; MSSD) is an imprecise measure of the readiness of response. In other words, if personality can be characterized by action tendencies, these should be modeled more continuously as rates of change. Between-person differences, to which a bulk of the personality literature has been devoted to, capture the frequencies, latencies, or persistence, while within-person relationships capture rates of change (Revelle & Condon, 2015), analogous to the relationship between distance and velocity in physical spaces. Differential equations describe the relationship between the level of variable and its derivatives with respect to time (Boker, 2004).

Despite this, personality has not been modeled as a set of differential equations where both distance (e.g., frequency), velocity, and acceleration are captured, with one notable exception (see Revelle & Condon, 2015).

An important step in understanding how personality operates in everyday life and why personality predicts a number of consequential life outcomes is to test whether personality, as measured in everyday life, can be use estimate “readiness for response” as the velocity (first derivative with respect to time) and whether the velocity predicts similar life outcomes as levels of personality do. If velocity provides unique information above and beyond level, this should prompt personality psychologists to search for techniques to recover velocity from level and whether better techniques for assessing velocity, perhaps even nomothetically, should be an important and active area of investigation (c.f. Beck & Jackson, 2020 for a more thorough discussion of differential equation modeling and dynamic systems in personality).

Conclusion

In this paper, we provided a historical summary of within-person variability in personality. Since personality psychology emerged as a field, it tried address two seemingly different questions, one concerning the nature of individual differences between people, and one concerning individual differences within a person (or within-person variability). But these two questions may not be as divergent as was once thought.

We argue that the path to integrating the two sciences of personality lies where personality began – with the study of the individual. The 20th century saw a wealth of research on between-person differences, but the 21st century has seen an explosion of research on within-person variability. We encourage researchers to take this work one step further and to model *individuals idiographically*, rather than individuals within populations. This, coupled with

models optimized for including a larger number of predictors and to incorporating time explicitly into models, offers a path for testing the Allportian definition of personality first proffered nearly 100 years ago.

References

- Allport, G. W. (1937). *Personality: A psychological interpretation*.
- Allport, G. W. (1961). *Pattern and growth in personality*.
- Allport, G. W. (1965). *Letters from jenny*. New York: Harcourt, Brace & World.
- Allport, G. W., & Odbert, H. S. (1936). Trait-names: A psycho-lexical study. *Psychological Monographs*, 47(1), i.
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, 4(3), 359-373.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bandura, A. (1999). Social cognitive theory of personality. *Handbook of Personality*, 2, 154-196.
- Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-Efficacy Beliefs of Adolescents*, 5(1), 307-337.
- Barenbaum, N. B., & Winter, D. G. (2008). History of modern personality theory and research. *Handbook of Personality: Theory and Research*, 3, 3-26.
- Beck, E. D., & Jackson, J. J. (2017). The search for a bridge: Idiographic personality networks. *European Journal of Personality*, 31, 530-532.
- Beck, E. D., & Jackson, J. J. (2019). Consistency and change in idiographic personality: A longitudinal ESM network study. *Journal of Personality and Social Psychology*.

- Beck, E. D. & Jackson, J. J. (in press). Idiographic Traits: A Return to Allportian Approaches to Personality. *Current Directions in Psychological Science*.
<https://doi.org/10.1177/0963721420915860>
- Beck, E. D. and Jackson, J. J. (2020). Network approaches to representing and understanding psychological dynamics. In Wood, D., Read, S., Harms, P., and Slaughter, A., editors, *Measuring and Modeling the Person and Situation*. Elsevier, 1st edition.
- Beck, E. D., Specht, J., Bleidorn, W., & Jackson, J. J. (2019) Do major life events change personality? A propensity-score matching approach.
- Bem, D. J., & Allen, A. (1974). On predicting some of the people some of the time: The search for cross-situational consistencies in behavior. *Psychological Review*, 81(6), 506.
- Block, J. (1983). *Lives through time*. Psychology Press.
- Bolger, N., & Laurenceau, J. P. (2013). *Intensive longitudinal methods*. New York, NY: Guilford.
- Borkenau, P., & Ostendorf, F. (1998). The Big Five as states: How useful is the five-factor model to describe intraindividual variations over time?. *Journal of Research in Personality*, 32(2), 202-221.
- Borsboom, D., Mellenbergh, G. J., & Van Heerden, J. (2003). The theoretical status of latent variables. *Psychological Review*, 110(2), 203.
- Buss, D. M., & Craik, K. H. (1983). The act frequency approach to personality. *Psychological Review*, 90(2), 105.
- Cattell, R. B. (1943). The description of personality: Basic traits resolved into clusters. *The Journal of Abnormal and Social Psychology*, 38(4), 476.
- Cattell, R. B. (1946). *Description and measurement of personality*.

- Cattell, R. B. (1957). *Personality and motivation structure and measurement*.
- Cattell, R. B., Eber, H. W., & Tatsuoka, M. M. (1970). *Handbook for the sixteen personality factor questionnaire (16 PF): In clinical, educational, industrial, and research psychology, for use with all forms of the test*. Institute for Personality and Ability Testing.
- Chaplin, W. F., & Goldberg, L. R. (1984). A failure to replicate the Bem and Allen study of individual differences in cross-situational consistency. *Journal of Personality and Social Psychology*, 47(5), 1074.
- Conner, T. S., Tennen, H., Fleeson, W., & Barrett, L. F. (2009). Experience sampling methods: A modern idiographic approach to personality research. *Social and Personality Psychology Compass*, 3(3), 292-313.
- Craik, K. H. (2000). The lived day of an individual: A person-environment perspective. *Person-Environment Psychology: New Directions and Perspectives*, 2, 233-266.
- Damian, R. I., Spengler, M., Sutu, A., & Roberts, B. W. (2018). Sixteen going on sixty-six: A longitudinal study of personality stability and change across 50 years. *Journal of Personality and Social Psychology*.
- Donnellan, M. B., Conger, R. D., & Burzette, R. G. (2007). Personality development from late adolescence to young adulthood: Differential stability, normative maturity, and evidence for the maturity-stability hypothesis. *Journal of Personality*, 75(2), 237-264.
- Epskamp, S., Waldorp, L. J., Mõttus, R., & Borsboom, D. (2018). The Gaussian Graphical Model in Cross-Sectional and Time-Series Data. *Multivariate Behavioral Research*, 1-28.
- Epstein, S. (1979a). Explorations in personality today and tomorrow: A tribute to Henry A. Murray. *American Psychologist*, 34(8), 649.

- Epstein, S. (1979b). The stability of behavior: I. On predicting most of the people much of the time. *Journal of Personality and Social Psychology*, 37(7), 1097.
- Epstein, S. (1980). The stability of behavior: II. Implications for psychological research. *American Psychologist*, 35(9), 790.
- Epstein, S. (1983). Aggregation and beyond: Some basic issues on the prediction of behavior. *Journal of Personality*, 51(3), 360-392.
- Fisher, A. J., Medaglia, J. D., & Jeronimus, B. F. (2018). Lack of group-to-individual generalizability is a threat to human subjects research. *Proceedings of the National Academy of Sciences*, 201711978.
- Fleeson, W. (2001). Toward a structure-and process-integrated view of personality: Traits as density distributions of states. *Journal of Personality and Social Psychology*, 80(6), 1011.
- Fleeson, W. (2007). Studying personality processes: Explaining change in between-persons longitudinal and within-person multilevel models.
- Fleeson, W., & Gallagher, P. (2009). The implications of Big Five standing for the distribution of trait manifestation in behavior: Fifteen experience-sampling studies and a meta-analysis. *Journal of Personality and Social psychology*, 97(6), 1097.
- Fraley, R. C., & Roberts, B. W. (2005). Patterns of continuity: a dynamic model for conceptualizing the stability of individual differences in psychological constructs across the life course. *Psychological Review*, 112(1), 60.
- Gates, K. M., & Molenaar, P. C. (2012). Group search algorithm recovers effective connectivity maps for individuals in homogeneous and heterogeneous samples. *NeuroImage*, 63(1), 310-319.

- Hampson, S. E. (2012). Personality processes: Mechanisms by which personality traits “get outside the skin”. *Annual Review of Psychology*, 63, 315-339.
- Hampson, S. E., & Goldberg, L. R. (2006). A first large cohort study of personality trait stability over the 40 years between elementary school and midlife. *Journal of Personality and Social Psychology*, 91(4), 763.
- Hartshorne, H., & May, M. A. (1928). *Studies in the nature of character. Vol. I. Studies in deceit*. New York: Macmillan.
- Hill, P. L. & Jackson, J.J (2016) The Invest-and-Accrue Model of Conscientiousness. *Review of General Psychology*, 20, 141-154.
- Horstmann, K. T., Rauthmann, J. F., Sherman, R. A., & Ziegler, M. (2018). Unveiling an Exclusive Link: Predicting Behavior with Personality, Situation Perception, and Affect in a Pre-Registered Experience Sampling Study. Manuscript submitted for publication.
- Jackson, J. J., Connolly, J. J., Garrison, S. M., Leveille, M. M., & Connolly, S. L. (2015). Your friends know how long you will live: A 75-year study of peer-rated personality traits. *Psychological Science*, 26(3), 335-340.
- Jackson, J. J., Hill, P. L., & Roberts, B. W. (2012). Misconceptions of Traits Continue to Persist: A Response to Bandura. *Journal of Management*, 38(3), 745–752.
- Jones, A. B., Brown, N. A., Serfass, D. G., & Sherman, R. A. (2017). Personality and density distributions of behavior, emotions, and situations. *Journal of Research in Personality*, 69, 225-236.
- Judge, T. A., Jackson, C. L., Shaw, J. C., Scott, B. A., & Rich, B. L. (2007). Self-efficacy and work-related performance: The integral role of individual differences. *Journal of Applied Psychology*, 92(1), 107.

- Kenrick, D. T., & Funder, D. C. (1988). Profiting from controversy: Lessons from the person-situation debate. *American Psychologist*, 43(1), 23.
- Larson, R., & Csikszentmihalyi, M. (1983). The experience sampling method. *New Directions for Methodology of Social & Behavioral Science*.
- Leikas, S. and Ilmarinen, V. (2017), Happy Now, Tired Later? Extraverted and Conscientious Behavior Are Related to Immediate Mood Gains, but to Later Fatigue. *Journal of Personality*, 85: 603-615.
- Lewin, K. (1951). *Field theory in social science*.
- McAdams, D. P. (1997). A conceptual history of personality psychology. In *Handbook of Personality Psychology* (pp. 3-39).
- Mischel, W. (1968). *Personality and assessment*. Psychology Press.
- Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. *Psychological Review*, 80(4), 252.
- Mischel, W., & Peake, P. K. (1982). Beyond déjà vu in the search for cross-situational consistency. *Psychological Review*, 89(6), 730.
- Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review*, 102(2), 246.
- Molenaar, P. C. (2004). A manifesto on psychology as idiographic science: Bringing the person back into scientific psychology, this time forever. *Measurement*, 2(4), 201-218.
- Mroczek, D. K., & Spiro III, A. (2003). Modeling intraindividual change in personality traits: Findings from the Normative Aging Study. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 58(3), P153-P165.

- Ong, A. D., & Ram, N. (2017). Fragile and enduring positive affect: implications for adaptive aging. *Gerontology*, 63(3), 263-269.
- Parrigon, S., Woo, S. E., Tay, L., & Wang, T. (2017). CAPTION-ing the situation: A lexically-derived taxonomy of psychological situation characteristics. *Journal of Personality and Social Psychology*, 112(4), 642.
- Piccirillo, M. L., Beck, E. D., & Rodebaugh, T. L. (2019). A clinician's primer for idiographic research: Considerations and recommendations. *Behavior Therapy*.
- Rafaeli, E., Rogers, G. M., & Revelle, W. (2007). Affective synchrony: Individual differences in mixed emotions. *Personality and Social Psychology Bulletin*, 33(7), 915-932.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). Sage.
- Rauthmann, J. F., Gallardo-Pujol, D., Guillaume, E. M., Todd, E., Nave, C. S., Sherman, R. A., ... & Funder, D. C. (2014). The Situational Eight DIAMONDS: A taxonomy of major dimensions of situation characteristics. *Journal of Personality and Social Psychology*, 107(4), 677.
- Roberts, B. W., Caspi, A., & Moffitt, T. E. (2001). The kids are alright: growth and stability in personality development from adolescence to adulthood. *Journal of Personality and Social Psychology*, 81(4), 670.
- Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychological Bulletin*, 132(1), 1.
- Robins, R. W., Tracy, J. L., & Sherman, J. W. (2007). What kinds of methods do personality psychologists use. *Handbook of Research Methods in Personality Psychology*, 673-678.

- Rosenzweig, S. (1958). The place of the individual and of idiodynamics in psychology: A dialogue. *Journal of Individual Psychology*, 14(1), 3.
- Sherman, R. A., Rauthmann, J. F., Brown, N. A., Serfass, D. G., & Jones, A. B. (2015). The independent effects of personality and situations on real-time expressions of behavior and emotion. *Journal of Personality and Social Psychology*, 109(5), 872.
- Shoda, Y., Mischel, W., & Wright, J. C. (1994). Intraindividual stability in the organization and patterning of behavior: Incorporating psychological situations into the idiographic analysis of personality. *Journal of Personality and Social Psychology*, 67(4), 674.
- Sibley, C. G., & Overall, N. C. (2008). Modeling the hierarchical structure of attachment representations: A test of domain differentiation. *Personality and Individual Differences*, 44(1), 238-249.
- Specht, J., Egloff, B., & Schmukle, S. C. (2011). Stability and change of personality across the life course: The impact of age and major life events on mean-level and rank-order stability of the Big Five. *Journal of Personality and Social Psychology*, 101(4), 862.
- Wagerman, S. A., & Funder, D. C. (2007). Acquaintance reports of personality and academic achievement: A case for conscientiousness. *Journal of Research in Personality*, 41(1), 221-229.
- Windelband, W. (1894). History and natural science. *Inaug. Addr. Strassburg*.
- Windelband, W. (1904). *Geschichte und Naturwissenschaft: Rede...* Heitz.
- Wright, J. C., & Mischel, W. (1987). A conditional approach to dispositional constructs: the local predictability of social behavior. *Journal of Personality and Social Psychology*, 53(6), 1159.

- Wood, D., & Roberts, B. W. (2006). Cross-sectional and longitudinal tests of the Personality and Role Identity Structural Model (PRISM). *Journal of Personality*, 74(3), 779-810.
- Zou, H., & Hastie, T. (2005). Regularization and variable selection via the elastic net. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 67(2), 301-320.
- Zuckerman., M. (1979). Traits, states, situations, and uncertainty. *Journal of Behavioral Assessment*, 1, 43-53.

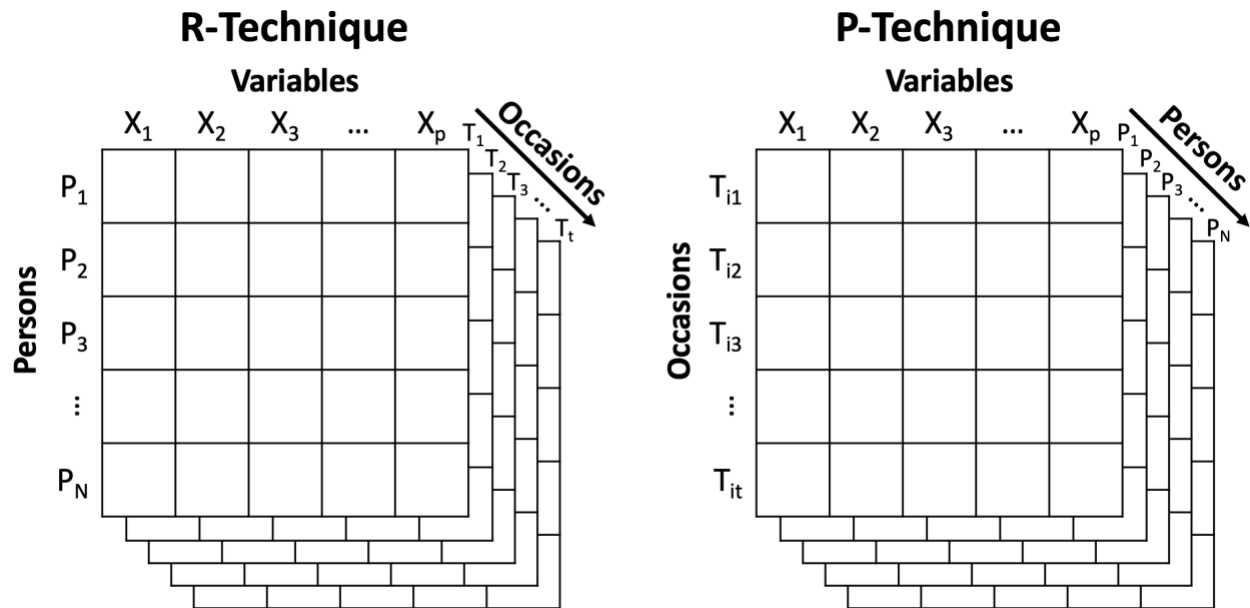


Figure 1. Two ways to “slice” the Cattell’s (1946b) data box to produce R-technique (nomothetic) and P-technique (idiographic) factor analytic structures. In R-technique, one collapses across or slices across the occasions dimension (T) to get the common structure of variables across individuals. In P-technique, one slices across individuals to find the unique structure of variables at the within-person level across time.