CHAPTER 5

Idiographic Personality

The Theory and Practice of Experience Sampling

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Since the early days of psychological research, scientists have promoted more personalized and contextualized approaches to understanding personality. These approaches, exemplified by theorists, including Allport, Mischel and many others, all share a commonality—they encourage the use of idiographic methods, which seek to identify patterns of behavior within an individual over time and within contexts, rather than to strictly identify patterns of behavior across individuals, as is the case with standard nomothetic approaches. In the science of personality, methods known as *experience sampling* are essentially modern-day tools for realizing a within-person, idiographic approach; these methods provide researchers with multiple snapshots of people's situated experiences over time in the context of daily life.

In this chapter, we review experience sampling methods (ESMs) as tools for use in the science of personality. We describe the basic method, give a brief history, and ground its rationale in several idiographic perspectives. We then give a short "how to" primer, admit some practical and theoretical complexities, and end by discussing exciting future directions for ESM and its contributions to personality theory. Throughout the chapter, we emphasize personality applications and pay special attention to computerized ESM using personal digital assistants (PDAs). In this way, we hope to supplement the excellent methodology reviews that currently exist (see Recommended Readings).

Experience Sampling Methods

ESM refers to a collection of procedures that are designed to allow respondents to report their thoughts, feelings, and behaviors over

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time in natural settings. Originally, "the Experience Sampling Method" (coined by Larson & Csikszentmihalyi, 1983) referred to a particular technique whereby participants reported on their experiences in response to a random signaling device like a pager. Today, ESM is often used more broadly to refer to any procedure that has three qualities—assessment of experiences in *natural settings*, in *real time* (or close to the occurrence of the experience being reported), and on *repeated time* occasions. Reports can be made in response to a random signaling device (e.g., Larson & Csikszentmihalyi, 1983), at predetermined times during the day (e.g., noon, 2:00 P.M., 4:00 P.M., nightly), or following a particular event (e.g., like a social interaction; Reis & Wheeler, 1991). Note that experience sampling methods are also referred to as *diary methods* (Bolger, Davis, & Rafaeli, 2003) or *daily process methods* (Tennen, Affleck, & Armeli, 2003). In health-related fields, the term *ecological momentary assessment* (EMA) is used (Stone & Shiffman, 1994) to refer to experience sampling, as well as to procedures that sample aspects of a person's physical state (e.g., ambulatory blood pressure or heart rate).

A History of Experience Sampling in Brief

The self-recording of everyday experiences began in the early years of social science. Precursors to modern-day experience sampling methods were sociological in nature and designed to gather detailed accounts of how people spent their time (for a detailed history, see Wheeler & Reis, 1991). Participants were given booklets of paper-and-pencil diaries and asked to keep a daily record of their activities each day. With the influence of behaviorism, early sampling methods in the science of psychology were used mostly for recording concrete behavioral events (cf. Wheeler & Reis, 1991). Later, as behaviorism waned, recording methods were applied to the study of internal subjective states, most notably mood.

The 1970s and early 1980s saw the development of modern-day experience sampling methods. Paper-and-pencil diaries were combined with audible beepers to allow for the spontaneous sampling of subjective experience (see, e.g., Csikszentmihalyi, Larson, & Prescott, 1977; Hurlburt, 1979). Researchers also developed the Rochester Interaction Record (Nezlek, Wheeler, & Reis, 1983), which was the first formalized "event-contingent" sampling procedure that allowed people to record their experiences on paper-and-pencil records immediately following predefined events.

Personality researchers quickly added experience sampling methods to their methodological toolbox. During the 1980s and early 1990s, there was a threefold increase in the use of sampling procedures (Tennen, Suls, & Affleck, 1991), culminating in a 1991 special issue of the *Journal of Personality* dedicated to personality and daily experience (Tennen et al., 1991). Early applications included investigations of daily affective experience (e.g., Eckenrode, 1984; Zevon & Tellegen, 1982) and stress (e.g., Bolger & Schilling, 1991), as well as motivation, self-esteem, and interpersonal relations (see Tennen et al., 1991).

The 1990s saw two developments in the sophistication of the method. First, on the implementation side, technology and software became available to fully computerize sampling (e.g., the Experience Sampling Program, ESP; Barrett & Barrett, 2001). Computerized sampling was first accomplished with the use of handheld or "palmtop" computers (see, e.g., Penner, Shiffman, Paty, & Fritzsche, 1994) and, later, with the smaller personal digital assistants (PDAs; also called pocket PCs) (see, e.g., Oishi, 2002). Second, on the data analysis side, multilevel modeling procedures became more widely used, allowing for simultaneous modeling of idiographic (within-person) and nomothetic (between-persons) relationships in ESM data.

Rationale for Experience Sampling

There are several reasons why personality researchers adopted ESM. First, ESM is a powerful method that captures nuanced *within-person patterns* otherwise unattainable from standard cross-sectional or longitudinal designs in personality.[1] These nuanced patterns provide insight into the dynamic regularities of personality *in situ*, and they reveal, rather than assume, behavioral patterns that are true for a given individual. Second, ESM measures *experience in natural contexts*. By taking personality research out of the lab, researchers can study how people behave in their environments that really matter—as people work, play, and interact with those they love and loathe. Third, ESM provides better measurement of *situation-specific behavior*, revealing how personality is grounded in situations. Fourth, ESM measures *actual rather than recalled experience*. We address each of these points in turn.

Within-Person Patterns

By virtue of its intensive repeated measures design, ESM is a powerful idiographic method that can reveal within-person patterns in personality. In the modern usage of the term, *idiographic methods* aim to identify patterns of behavior *within the person* across time and in context; in contrast, *nomothetic methods* aim to identify general patterns of behavior *across people*.[2] The rationale for idiographic methods in personality research can be traced back to Gordon Allport, who, seven decades ago, rallied against the strict nomothetic approaches to personality of the time (Allport, 1937). He argued that conceptualizations of personality derived from across-individual analyses reflect the psychology of a nonexistent average individual that neglects the unique patterning of personality within the individual. As a modern method in personality research, ESM realizes an idiographic approach, not through the "low-powered" single case studies, as idiographic methods were sometimes conceived in the past, but through "high-powered" multiple, ongoing case studies that allow researchers to determine idiographic relations and then to make lawful generalizations. For example, using ESM data, researchers can generate an idiographic index for each person. This index may be a within-person average (reflecting a reliable aggregate of that person's experience over the sampling period; e.g., Epstein, 1983); it may be a within-person slope (reflecting change in a reported experience over time or the relation between two reported experiences for an individual; e.g., Bolger & Schilling, 1991); or it could be any other index that captures some meaningful pattern for that individual (within-person factor structure, e.g., Barrett, 1998; standard deviation, e.g., Eid & Diener, 1999; spectral density estimates, e.g., Larsen, 1987). Then, investigators can determine whether these indices vary across individuals. If indices vary, steps can be taken to model whether other factors such as demographic characteristics or personality traits account for some of the variability. In this way, ESM weds the specificity of within-person idiographic analyses with the goal of nomothetic inference. This type of hybrid idiographic–nomothetic design has also been called *idiothetic* (Lamiell, 1981), as well as *ipsative–normative* (Lazarus, 2000), wherein *ipsative* refers to deviations around the individual mean and *normative* refers to deviations around the group mean.

Within-person analyses are as relevant to today's scientific investigation of the human personality as they were nearly 70 years ago. Within-person analyses aid theory building by avoiding the nomothetic fallacy (i.e., assuming that what is true for the "average" person is also true for each and every person). For example, many cross-sectional studies of affect have identified valence (pleasure–displeasure) as a basic property of affective experience (see, e.g., Russell, 1980), but only idiographic methods using ESM have demonstrated that valence is a property of each and every respondent's experience (for a review, see Barrett, 2006). Thus, idiographic methods are useful for testing when and for whom a theory is valid. Idiographic methods also yield patterns that cannot be assumed from cross-sectional designs. As a general rule, within-person associations and across-persons associations are conceptually and methodologically independent (Nezlek, 2001), so that one can never be inferred from the other. In fact, within- and across-persons associations can depart in both size and direction, as illustrated by Tennen and Affleck (1996). They describe a study in which participants reported on pleasant and unpleasant daily events over time. Two types of correlations were computed—a set of within-person correlations (the association between pleasant and unpleasant events over time for each person) and a between-persons correlation (the association between the aggregated number of pleasant and unpleasant events across persons). The within-person correlations were mostly negative, showing that on days when people experienced more pleasant events, they typically experienced fewer unpleasant events. But the between-persons correlation was positive ($r = .50$), showing that people who experienced more pleasant events on average also experienced more unpleasant events (i.e., they had eventful lives). Although informative for certain research questions, the between-persons correlation does not reveal the temporal patterning of events in individuals' lives.

Measurement of Experience in Natural Contexts

ESM takes personality research out of the lab and into real life, realizing Gordon Allport's vision that "psychology needs to concern itself with life as it is lived" (Allport, 1942, pp. 56; see also Bolger et al., 2003). Sampling experiences *in vivo* (in life) and *in situ* (in place) contrasts markedly with many standard ways of assessing personality that often neglect the varied and rich context of life. Having people fill out questionnaires about how they behave "in general" (called a *global self-report*) does not adequately capture behavior as it unfolds over time and across situations. Furthermore, laboratory-based experiments do not always approximate real life. Consider the value of natural reporting contexts in the study of intimate relationships. By using ESM, researchers have been able to measure how couples seek out and respond to each other emotionally in daily life, revealing systematic factors that promote feelings of intimacy (see, e.g., Laurenceau, Barrett, & Pietromonaco, 1998).

Better Measurement of Situation-Specific Behavior

By measuring people's experiences across situations, ESM allows for a more conditional conceptualization of personality. *Conditionality* refers to the way in which people interpret their surroundings to produce a psychological situation that is most potent for the expression of personality. From this perspective, personality reflects the tendency to behave in a particular way within certain situations rather than the tendency to behave the same way across all situations. As exemplified by Mischel and Shoda's situation-specific signatures, some individuals who are classified as "aggressive" may behave aggressively only when hassled by a peer, whereas others may show aggressive behaviors only when reproached by an adult (Shoda, Mischel, & Wright, 1994). Similarly, individuals high in neuroticism may not feel distressed all the time, but only when faced with situational press (such as a perceived threat) (Bolger & Schilling, 1991). With ESM, researchers can model these signatures by having respondents report on properties of the psychological situation (i.e., construals of current threat, stress, and so on) as well as physical surroundings (i.e., the location, the number of other people present, interacting with a peer or supervisor).

Measurement of Actual Experience Rather than Recalled Experience

ESM also captures experiences in real time, rather than relying on people's retrospective reports as proxy measures for momentary experiences. Retrospective questionnaires are pervasive in the science of psychology. Popular instruments such as the Beck Depression Inventory, the Positive and Negative Affect Schedule (PANAS), and numerous widely used quality-of-life surveys (e.g., Symptom Checklist-90—Revised, SF-36 Health Questionnaire) often ask people to reflect back on their affective and somatic experiences over the past 2 weeks, or even months. The validity of these measures rests on the assumption that people can accurately remember their experiences as they occurred during these intervals and summarize them by taking an average. Yet the assumption that people can both remember and summarize their prior experiences is not warranted. Consider what happens when we ask people to report on something like "How sad have you felt over the past 2 weeks?" To answer this question, respondents may first attempt to reflect back over the past 2 weeks, think about specific episodes of feeling sad, and then summarize them (a *recall-and-aggregate* strategy). In this process, however, summaries will be disproportionately influenced by the strongest experiences during the time frame (*peak effect*), by the most recent experience (*end effect*) (for a review, see Fredrickson, 2000), and by the respondent's current affective state.

Alternatively, people may not even attempt a recall-and-aggregate strategy when retrospecting on experiences over longer intervals, instead adopting a "semantic" strategy—reporting what they *believe* they felt (Robinson & Clore, 2002b). This shift to a semantic strategy was demonstrated in a study that measured the latency for individuals to judge their emotional experiences over increasingly longer (and more difficult) time frames (e.g., "To what extent do (did) you feel happy *at this moment*, the *last few hours*, *days*, *weeks*, *months*, *years*, *in general*?") (Robinson & Clore, 2002b). Response latencies increased in a linear fashion over the shorter intervals (moment, last few hours, days) as participants took time to recall and aggregate experiences; however, at the longer intervals (weeks, months, years, in general), response latencies sharply decreased, suggesting that participants stopped trying to recall and aggregate their past experiences and simply began accessing an already cached knowledge source. The knowledge appears to reflect people's stable, generalized beliefs about themselves and their experiences (reviewed in Robinson & Clore, 2002a).

Several examples illustrate the value of capturing experiences unfiltered from belief-based reconstruction. In studies of gender differences in emotional experience, for example, reports made using retrospective or global questionnaires often reveal strong gender differences consistent with the cultural stereotype that women are the more "emotional sex" (Barrett, Robin, Pietromonaco, & Eyssell, 1998). However, when immediate reports using ESM are used, these differences disappear (Barrett et al., 1998). Why would the depiction of the emotional lives of men and women differ depending on how we asked the questions? The reason is that in retrospect and in the abstract, people rely on knowledge other than what actually happened, including gender stereotypes and implicit theories, to help inform their self-reports of experience.

Belief-based reconstruction also has implications for studies of personality change. In some cases, the use of retrospective questionnaires may *overestimate* the amount of change that has actually occurred. For example, if people are asked to recollect how they were some time ago, they may remember themselves as being worse off so that their present-day self confirms a belief that they are improving (Ross & Wilson, 2003). In other cases, the use of retrospective inventories may *underestimate* change. Consider a study in which a depression inventory is administered before and after an intervention of some sort. If the inventory contains a retrospective component (e.g., "Reflect back on the past 2 weeks"), both reports will be infused with participants' beliefs about their depressed nature and, in turn, show high stability. But most interventions are not designed to change beliefs; they are designed to change the actual depressive symptoms in daily life. ESM provides the means to measure those symptoms directly.

Applying ESM to Personality Research

In this section, we review the primary ways in which ESM has been used in personality research. Because of space considerations, we highlight only selected examples of ESM studies that examine the *phenomenological content of daily life*, *daily processes*, the *structures of daily experience*, and *temporal changes in experience* as means of understanding personality.

Phenomenological Content Investigations

Phenomenological content investigations are those in which ESM is used to examine conscious representations of phenomenological experience in daily life (e.g., mood, daily events, pain, coping). In these investigations, participants report on their experience across time and situations; reports are then averaged and examined for their links to other variables of interest. Content investigations are often used to demonstrate the links between personality characteristics and situated experience. For example, studies using ESM have shown that stable personality factors such as neuroticism (e.g., Barrett & Pietromonaco, 1997), pessimism and optimism (Norem & Illingworth, 1993), and dispositional approach/avoidance-related motivations (Updegraff, Gable, & Taylor, 2004) all predict average levels of affective experience *in situ*.

Daily Process Investigations

In daily process investigations, ESM is used to investigate how two self-report variables covary within the person over time. The resulting "within-person slopes" capture the relations between situational, cognitive, or affective factors in daily life (e.g., the relation between stressful events and affective experience). Daily process research is extremely powerful and at the core of many ESM applications in personality. Such research has revealed strong within-person links between daily stressful events and negative affect (Bolger & Schilling, 1991), attributions of control and feelings of depression (Swendsen, 1998), and certain situations and the likelihood of behaviors detrimental to health (e.g., drinking; Mohr et al., 2001), among other notable applications. Daily process researchers also recognize that within-person slopes commonly vary in size or direction. In these situations, researchers typically ascertain whether there are other factors that might account for the variation (e.g., neuroticism predicts stronger stressor–affect slopes; Bolger & Schilling, 1991).

Structural Investigations

Structural investigations seek to discover the (often implicit) properties that characterize reports of momentary experience. In these applications, ESM is used to obtain reports of multiple experiences over time (e.g., current happiness, sadness, anger, etc), which are then factor analyzed for each person to determine the dimensions (or "structure") that account for regularities in experience (see, e.g., Barrett, 1998, 2005; Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Nesselroade, 2001). Such investigations have revealed common structures in momentary affective experience (e.g., valence and arousal dimensions; Feldman, 1995), as well as individual differences in the structure of experience (see, e.g., Barrett, 1998). For example, ESM research shows that some people are much more likely to characterize their affective experiences in broad, global terms (e.g., as good vs. bad), whereas others may make more complex distinctions—a difference termed *emotional granularity* (Barrett, 1998). It is important to note that such discoveries can be determined only through structural analysis of repeated measures reports and not by directly asking people what they believe the structure to be.

Temporal Investigations

In temporal investigations, ESM is used to measure changes in experience (e.g., mood, social behavior, coping) across time. Such investigations have revealed temporal patterns in mood (see, e.g., Larsen & Kasimatis, 1990), as well as individual differences in mood variability (Eid & Diener, 1999) and entrainment to normative cycles (Larsen & Kasimatis, 1990). Furthermore, important trait factors such as neuroticism and extraversion predict variance in these within-person patterns—for instance, higher neuroticism predicts greater variability (Eid & Diener, 1999) and greater extraversion predicts less entrainment to weekly mood cycles (Larsen & Kasimatis, 1990). Temporal investigations have also shown that there are patternings across time in several personality markers, including Big Five characteristics (Fleeson, 2001) and trait mindfulness (Brown & Ryan, 2003). Moreover, research has shown that within-person variability in experiences is itself stable (Eid & Diener, 1999; Fleeson, 2001).

A Brief Primer on ESM

ESM is a valuable research tool, but it involves a design and implementation process that can be challenging to even the most seasoned researcher. In this section, we present several steps for successfully designing and launching an ESM study. These steps are part of a growing corpus of guidelines dedicated to sampling science (for other primers see Recommended Readings). Note that our discussion is mainly targeted to studies using "normal" adult samples (college students, community members) and we do not discuss the use of ESM for populations with specific needs (young children, elderly persons, individuals with psychopathology, and so on; see deVries, 1992, for uses of ESM in clinical populations).

Resources

The feasibility of conducting an ESM study depends on three primary resources. A *strong and conscientious research team* is integral to the success of any study, especially studies utilizing ESM. In addition, having the *resources to remunerate* participants is important because of the taxing nature of participation. It is useful to remunerate participants both as the study progresses (for meeting milestones during the observation period) and at the end of the study (usually with a cash payment). Offering enough incentive and remuneration throughout the sampling procedure (although not too much so as to be coercive) can proactively reduce attrition. There are a variety of potential remuneration sources, including research credits (if using college student participants), monetary payment, and other creative items such as weekly/monthly drawings (e.g., gift certificates to restaurants, university sweatshirts, tickets to functions) or larger "grand prizes" (e.g., PDAs). Also consider *resources for the sampling platform.* ESM platforms range in cost, from higher-cost computerized sampling (using palmtop computers or PDAs) to lower-cost paper-and-pencil options (see the section "Choosing the Platform" below). An awareness of resources early on allows you to choose the platform that accommodates your budget and, if possible, to find more financial support.

Designing the Sampling Protocol

The next step is to design the sampling protocol—how to sample experiences and how frequently to do it. These decisions must be based on how the phenomenon under study is thought to behave. If the phenomenon of interest is relatively rare, such as experiences surrounding unprotected sex, sampling at random moments during the day is inefficient and likely to miss the behavior of interest. Such behaviors can be recorded reliably after each event. If the behavior of interest is ongoing (e.g., mood), then sampling throughout the day will work better. Note that a critical function of ESM data is to represent a *population of occasions*, just as cross-sectional data functions to represent a population of individuals. Thus, researchers need to ensure that the data capture enough occasions with enough frequency to adequately represent the phenomenon under study.

One of the first decisions to make is whether to use an *event-based* versus *time-based* sampling protocol (Bolger et al., 2003). With event-based sampling, people make their reports following a predefined event. This type of protocol, also called event-contingent sampling (Wheeler & Reis, 1991), is best used for investigating experiences and behaviors surrounding specific events, especially those that are rare and may not be occurring if sampling is done at fixed or intermittent times during the day (e.g., instances of drinking, lying, smoking, social events). Event-contingent procedures can be challenging to participants especially if the events are frequent (e.g., every social interaction) or too broadly defined. It is important to set clear and appropriately inclusive criteria.

With time-based sampling, people make their reports at designated or varied times. Time-based sampling is more typical and is used for investigating experiences that occur frequently in a person's daily life (e.g., daily events, stressors, coping, etc.) or are ongoing (mood, stress). If using time-based sampling, consider whether to use a *fixed schedule* or *variable schedule*. With a fixed schedule, also called interval-contingent sampling (Wheeler & Reis, 1991), people make their reports at fixed times throughout the day (e.g., at morning, afternoon, and evening intervals or at night daily). They may be asked to report on their experiences at that current moment (an immediate or "online" report) or, more typically, to report on their experiences that occurred during the time frame since the previous report (over the prior interval). This latter format requires some retrieval or reconstruction over a period of time and is best used for studying concrete events and behaviors that are less susceptible to memory bias (e.g., using a checklist of daily events). Fixed schedules are also well suited to time series (temporal) investigations. The fixed nature of observations allows one to make generalizations about time (e.g., diurnal or weekly patterns in mood) by statistically comparing responses within and between individuals. Finally, fixed schedules are also typically the least burdensome to participants—reports are made at standardized times and so participants can configure their schedules around these reports. This regularity can be a drawback, however. If people make their own reports, or initiate them in response to a signal at a fixed time, their reports will not reflect spontaneous contents in the stream of consciousness; reports may also be susceptible to mental preparation and/or self-presentation. If these issues are of concern, then a variable schedule can be used, or the fixed schedule "relaxed," so that prompts are delivered less predictably around specified times.

With a variable schedule, also called signal-contingent sampling (Wheeler & Reis, 1991), people make their reports in response to a signal that is delivered at unpredictable times, typically between 4 and 10 times per day. At each signal, people are typically asked about experiences occurring at that particular moment (i.e., How are you feeling *right now*?). Variable schedules are well suited for studying target behaviors that are ongoing and therefore likely to be occurring at a given signal (e.g., mood, pain, stress levels). They are also appropriate for studying states that are susceptible to retrospective memory bias (e.g., emotions, subjective well-being, or any experience quick to decay), as well as states that people may attempt to regulate if they could anticipate having to make a report (as with a fixed schedule). The main disadvantage of signal-contingent sampling is the burden to participants, who are interrupted by the signals. But participants typically become accustomed to the procedure rather quickly (within 2 days).

Other important decisions to make are the sampling parameters—the number of sampling moments per day and the length of the sampling period. These decisions can be made at the outset or later, after choosing the platform (computerized, paper-and-pencil, Web, etc.), and should first reflect the naturalistic incidence of target phenomena. For event-based procedures, the sampling period should be long enough to accommodate sufficient numbers of observations per person to provide a reliable estimate for that person. For time-based procedures, observations should be frequent enough during each day to capture important fluctuations in experience, but not so frequent as to inconvenience participants without any incremental gain (Reis & Gable, 2000). There are no set rules, but general guidelines have emerged. For example, Delespaul (2006) advises against sampling more than six times per day over longer sampling periods (i.e., 3 weeks +) unless the reports are especially short (i.e., 2 minutes or less) and additional incentives are provided. Variable schedules typically employ between 4 and 10 signals each day, and the signals are usually distributed throughout the day randomly within equal intervals. For example, in a study sampling eight times a day between the hours of 9:00 A.M. to 9:00 P.M., the first signal would come randomly between 9:00 and 10:30 A.M., the second signal would come randomly between 10:30 A.M. and 12:00 P.M., and so on, because there are eight 1½-hour intervals. Furthermore, if the experience of interest were hypothesized to be cyclical, the observations need to be frequent enough to catch the trough and peak of the cycle *at minimum*, although more observations are better. Otherwise, cycles will be missed or misidentified (an error known as *aliasing* in the time series literature).

Another consideration is statistical power, both in terms of the number of moments sampled and the number of participants involved. Power analysis programs are available for precisely determining the number of observations and sample size needed to estimate various effects (Bosker, Snijders, & Guldemond, 2003). In the absence of using these estimation procedures, we can offer several guidelines (see also Kreft & de Leeuw, 1998). In general, the number of observations needed for sufficient statistical power depends on the complexity of analysis. If using ESM to construct an aggregate measure (e.g., a mean across time), observations should be sufficient to achieve reliability, akin to constructing a reliable scale with multiple items. In published ESM research, aggregates are typically created with about 30 observations, although some studies have as few as 7 observations per person for a 1-week-long diary study.

Observations should be increased for more complex analyses that estimate both within (idiographic) and between (nomothetic) variance components (i.e., cross-level interactions using multilevel modeling procedures; Nezlek, 2001). For example, in their discussion of multilevel power, Kreft and de Leeuw (1998, pp. 125) reviewed several simulation studies suggesting that when testing cross-level interactions with small to moderate effect sizes, the study should include at least *30 people with 30 observations* in order to have sufficiently high power (.80). Presumably, these numbers can be adjusted up if using a more stringent alpha (e.g., .01). Kreft and de Leeuw also described research suggesting that increasing the number of people, rather than the observations, has a greater effect on the power to detect cross-level interaction effects. By these guidelines, ESM studies appear to be doing well in terms of power. Although normative estimates are hard to come by, the average number of observations for a variable schedule (signal-contingent) procedure is estimated to be between 56 and 168 (for studies that run for 1–2 weeks; Reis & Gable, 2000), with *N* ranging from 30 to 100. Moreover, to achieve adequate power, observations may have to be increased if the anticipated response rate is low. Generally, response rates tend to be highest (95% and above) for fixed scheduling procedures, especially those completed once daily. Response rates are typically lower (e.g., 70–85% on average) for variable schedules, employing computerized devices that signal multiple times per day.

Choosing the Platform

Next, choose the sampling platform. *Computerized sampling* uses palmtop computers or personal digital assistants (PDAs) outfitted with specialized configurable software that enables participants to answer questions about their experiences (for a discussion of computerized ESM, see Barrett & Barrett, 2001; Conner Christensen, Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003). Computerized sampling can be used with any of the sampling protocols—people can initiate the report themselves (for event and fixed sampling) or respond when cued by the device (for fixed and variable sampling)—but computerized procedures are especially beneficial for time-based protocols. Time-based protocols rest on the assumption that respondents will complete their reports at fixed times or immediately in response to a variable audible signal. Computerized methods control these timing elements, ensuring that reports are made on time and not from memory.[3] When self-initiated, a report is automatically "time-date" stamped. And, when cued, there is a short window to make the report and, again, a report is time-date stamped. Note that computerized methods do not ensure compliance with event-based procedures in which participants initiate their own reporting. Although every report is time-date stamped, researchers cannot know how much time has elapsed since the event, which can potentially introduce memory bias.

There are several other advantages of computerized experience sampling procedures. First, they allow for flexibility in how the questions are presented (randomly or in fixed order), which can reduce response sets and order effects. Second, they reduce human error associated with data management because data can be transferred directly from the PDA to a master computer without being entered by hand. Third, they provide the ability to record ancillary information, like latencies to respond to each question, which is not attainable with paper-and-pencil reports.

The disadvantages to computerized ESM start with the upfront financial investment. The cost of units can vary considerably (at the time of this writing the least expensive PDA was $100, and the most expensive that was linked to physiological recording was $12,000). There is also the potential cost for sampling software (which range from free to very costly; see the following section, "Choosing Software and Purchasing Equipment"). Computerized ESM also imposes limits on the question format (open-ended or "free" responses are not easily incorporated). Moreover, the platform may not be amenable for all subject populations. For example, the human factors of PDAs can be poor for some older individuals—the screens are small and the prompts are at high frequencies, which can make them difficult to hear.

There are several alternatives to computerized ESM. *Web platforms* are increasingly popular and well suited to a daily diary procedure. Every day participants can log onto a secured website and complete their reports, which are time-date stamped. A Web diary can also easily accommodate free text entries, which are not currently possible with handheld PDAs. However, not everyone has easy or frequent access to the Web and these platforms are not always cost-effective. A *paper-and-pencil platform* is the lowest-cost alternative. Questionnaire sheets, booklets, or any type of rating form can be designed and given to participants (for helpful guidelines, see Reis & Gable, 2000). Participants can then fill them out following specific events, at designated times, or when signaled by lower-cost pagers or programmable watches. The advantages of paper-and-pencil methods include reduced cost, less overhead in terms of equipment, and the allowance of open-ended questions. The disadvantages include the inability to randomize item content and a greater risk of noncompliant responding (see Stone, Shiffman, Schwartz, Broderick, & Hufford, 2002). Noncompliant responding occurs if people forget to fill out their reports at designated times; if they fill them out at the wrong times; or if they complete multiple reports later from memory (called *back-filling*). Fortunately, more recent research suggests that such concerns may be overstated and that establishing good working relationships is the best strategy for improving compliance (see Green, Rafaeli, Bolger, Shrout, & Reis, 2006). So, although rapport with participants is important for all ESM studies, it is critical for ESM studies using paper-and-pencil measures.

Choosing Software and Purchasing Equipment

In running a computerized ESM study, the next step is to choose the software, purchase the hardware units, and configure the devices. A more detailed description of software and equipment considerations can be found in Conner Christensen and colleagues (2003). At the time of this writing, there are several free software programs available for running computerized ESM studies using PDAs. They include the Experience Sampling Program (ESP; *www.experience-sampling.org*), the Intel Experience Sampling Program (iESP; *seattleweb.intel-research.net/projects/esm/iESP.html*), and the Purdue Momentary Assessment Tool (PMAT; *www.cfs.purdue.edu/mfri/pages/PMAT/Index.html*). Each can accommodate event- or time-based sampling protocols, although they have slightly different features. See their online manuals for a complete and updated list of requirements and features.

After selecting the software, purchase the hardware devices (e.g., PDAs), taking into account several factors, the most important of which is the operating system. The devices must run on the same operating system for which the software was designed (e.g., Windows CE, Windows Mobile 2003, Palm OS) and in the specific version. Also consider the size of the screen, the brightness and resolution, the sound of the audible signal, the length of warrantees, and customer support. Prior to purchasing an entire fleet, purchase a test PDA to make sure the software works on that model. Install the software, configure it according to your design, and pilot. If all is well, then purchase the rest of your fleet.

Configuration of the fleet usually involves a day or two of work. Each software program has its own instruction manual and process for configuring the PDAs. Configuration typically involves specifying the sampling protocol, the frequency of signals (if using an audible signal), the length of the sampling period, and the questions and response options. Prior to running the study, researchers should test all of the PDAs to make sure they work; pilot test a smaller number of units through the full procedure (i.e., aided by research assistants); and solicit feedback about the clarity of questions, formatting, and response features.

If using Web-based sampling, there are several options. Most researchers hire their own programmer to design the website. There is also commercial software that can be tailored for a repeated measures nightly diary. Although we cannot recommend any specific vendors, we can note that some companies sell the diary survey software outright (for around $1,500) without a per-survey usage fee, which can be very helpful for repeated assessments (for one example, see *www.snapsurveys.com*). In the future, we hope to see more freeware options available.

Implementing the ESM Study

Once participants are recruited, it is important to keep them motivated throughout the sampling period. There are several strategies for maintaining motivation, including having a complex remuneration structure with incentives such as money, research credits, and lotteries. Also crucial are positive attitudes on the part of the research team members, which translates into positive contact with participants. Through our own and others' experiences (see Green et al., 2006), we have observed that the data quality is highest when participants feel they are valued and have a sense of responsibility to their research assistant. Of course, participants should also clearly understand the study procedures. They should know how and when they will be asked to report and how to use the computerized device, if applicable. With such devices, it is best to have participants answer their first prompt in the lab, giving them an opportunity to ask questions and get comfortable with the device. In addition, during the study, feedback about response rates can increase the amount of usable data by making participants aware of any need to boost their response rates. Sometimes researchers tie payment to response rates (e.g., paying people for every report they make), which is a good strategy for daily diaries but may not work for more intensive signal-contingent sampling. Finally, if using computerized sampling, steps can be taken to minimize damage and wear of equipment. PDAs can be carried around in protective cases, and using top-of-the-line batteries can extend the life of the units because such batteries are less likely to corrode.

Preparing and Cleaning Data for Analysis

ESM yields volumes of data that must be entered, organized, and readied prior to any statistical analysis. Consider an ESM study with 100 participants. If each participant answers 40 items at 50 observation points, this study will potentially yield 200,000 data points! With paper-and-pencil sampling procedures, all data must be entered by hand—a lengthy and error-prone process, but certainly achievable. Computerized ESM bypasses this step because data are retrieved directly from the portable devices. This process eliminates manual data entry; however, careful steps must be taken not to inadvertently override or erase files. Once the data are entered, they are typically compiled and cleaned prior to analysis, with two steps unique to computerized ESM. First, the records are checked for duplicates (a common error is to compile the same data twice, leading to duplicate rows), and, second, trials with extremely fast reaction times are excluded and documented in the writeup (they typically indicate participant error such as an inadvertent screen tap).

Analyzing Data

After being compiled and cleaned, the data are ready to be analyzed according to the nature of the research question. If the goal is to understand something about each person (either an *average* for content investigations, or a *slope* for process investigations) and to examine how these indices might be moderated by other factors, then multilevel modeling may be especially useful (for primers, see Luke, 2004, as well as Kenny, Bolger, & Kashy, 2002; Kreft & de Leeuw, 1998; Nezlek, 2001). In multilevel modeling of ESM data, the "lower-level" data include all the self-reports obtained during sampling and the "upper-level" data include characteristics of the persons, typically measured separately from ESM (e.g., personality or cognitive variables), although not necessarily (e.g., an aggregate derived from ESM). The elegance of multilevel modeling is that it allows researchers to model certain patterns within each individual (using a lower-level equation), to test whether those patterns are the same or different (a variance test of the lower-level coefficients), and, if the patterns are different, to use upper-level predictors to account for that variance (so called cross-level interactions).

Multilevel modeling procedures echo the conceptual spirit of an idiographic framework. First, computing a lower-level regression equation for each person preserves the idiographic or intra-individual patterns. This equation might be simple (an *intercept only model* to estimate, for example, the average positive affect reported across 30 days for each person) or more complex (a *slope model* that regresses "affect" onto "perceptions of stress" to determine their relation for each person). Even when it appears that simple aggregation is occurring (e.g., as with an *intercept-only model*), multilevel modeling takes into account individual variability in the reliability of these intercepts, because some people have more stable estimates (i.e., those with a higher response rate). Furthermore, a variance test of the lower-level coefficients is, essentially, a test of the nomothetic assumption (i.e., whether "the average" is a good fit for most of the people in the sample). If the coefficients are homogeneous, then the average fits well. If the coefficients are heterogeneous, then the average fits less well, suggesting that other between-subjects factors might account for heterogeneity across participants.

For structural investigations involving the analysis of multiple co-occurrences between states, *P-factor analyses* can be used (Nesselroade, 2001). In these analyses, a correlation matrix is computed for each person using his or her ESM reports. This matrix reflects the extent to which changes in reports of one state (e.g., nervous) accompany changes in reports of another state (e.g., angry) for that person over time. Each *P*-correlation matrix can then be factor analyzed to statistically extract the dimensions that account for the variability in that person's experience.

Finally, there are also numerous procedures for investigating temporal patterns. Researchers have measured within-person variability by taking the standard deviation of a person's ESM reports over time (which, technically, reveals the *extremity of experience*; see, e.g., Eid & Diener, 1999), by examining skew and kurtosis (to reveal the *density of distributions*; Fleeson, 2001), and by employing spectral analysis (to reveal *rate of change*; Larsen, 1987). *Time-series analyses* are also powerful tools for determining cyclic patterns as well as other lagged effects (see West & Hepworth, 1991). Depending on the researcher's statistical sophistication, time series can be incorporated into multilevel modeling procedures.

Practical and Theoretical Complexities

Beyond the standard issues of implementation and analysis, there are several practical and theoretical complexities to consider.

Practical Complexities

Resource-Intense Method

Money can be a considerable obstacle for conducting ESM studies, especially given the current state of highly competitive grant funding for social and personality research. For computerized ESM studies, much of the expense requires capital upfront before the study is underway. Funds are required to purchase PDAs, pagers, or other devices. Other costs include software (if applicable) and participant remuneration. Together, these can add considerable expenses to one's budget. The most extreme cost-effective strategy is to avoid computerized sampling and instead use a simple paper-and-pencil diary—but this platform can be used only when appropriate to the research question. Fortunately, there are a number of ways to minimize costs and make the most of resources for a computerized study. Researchers can collect data in waves to minimize the number of PDA units needed, collaborate with others to share expenses (e.g., embed numerous research questions into the same protocol), and remunerate with research credits rather than money, whenever possible. They can also consider purchasing replacement PDAs upfront to save resources in the long run. As the PDAs become damaged, fresh units taken out of reserve will extend the lifetime of the fleet. We recommend purchasing about 20% replacement PDAs (e.g., 10 extra to maintain a fleet of 50).

Constraints in the Window of Observation

Because of time and resource limitations, ESM studies are typically constrained to data collection over a period of a few weeks at most. This window of observation may be a concern for researchers interested in determining regularities in behavior across a time span. To deal with this concern, researchers have a couple of options: First, depending on the particular research question, the sampling period can be extended to several weeks or even months. This option should be taken with caution, however, as it can raise the risk of participants providing set responses (i.e., responses become more routinized). Second, once the study has concluded, researchers can probe how typical these past weeks were as compared with their normal experience (e.g., by using a Likert-type scale, usual = 0 to unusual = 7), and responses used as covariates in analyses. Constraints in the window of observation may also be an issue for researchers who use college students as their subject sample. It is important to be mindful of the time of year when data are collected, as the ends of semesters are typically associated with higher stress levels compared to the beginnings of semesters.

Psychometric Issues

The same psychometric issues are important in ESM as with other questionnaire-type measures. Investigators should be careful about the ways in which questions are asked (e.g., framed in a positive versus negative way) and take caution in selecting scale anchors (e.g., unipolar rather than bipolar mood scales should be used).

Reactivity

ESM is unique in that it requires people to actively attend to and verbalize their experiences repeatedly over time (often as much as 10 times per day over several weeks). This raises the question about whether the repeated self-reporting of experience changes the very experience being measured (reactivity). Whereas studies in the EMA literature appear to demonstrate that participant reactivity is modest, clinical research on self-monitoring suggests that there could be reactivity in several circumstances (Korotitsch & Nelson-Gray, 1999).[4] First, reactivity may be more likely when people monitor only one type of target behavior or experience, especially a behavior that is negative or socially undesirable. This condition could be a concern for certain event-based studies, but it may be less a concern for time-based studies in which people report on multiple experiences of different valences at each time point. Second, reactivity appears likelier when participants are motivated to change the target behavior. In a revealing study (cf. Korotitsch & Nelson-Gray, 1999), individuals recruited by advertisements looking for "people who want to quit smoking" showed greater change in their smoking behaviors over time during sampling, as compared with others who were recruited for the same study looking for "people who are cigarette smokers." Thus, if reactivity is a concern, ESM researchers should be mindful not to inadvertently recruit people who are motivated to change the primary experience being sampled (e.g., emotion researchers should not advertise their studies to those who "want to feel happier"). Third, reactivity may occur if people are asked to report on experiences that they find difficult to verbalize. Research has shown that processing is disrupted when people are asked to describe experience that is more sensually or less linguistically based (i.e., enjoying the beauty in a sunset or a favorite song; see Schooler, Ariely, & Loewenstein, 2003). Finally, there is the risk that ESM, especially signal-contingent sampling, takes people "out of the moment." Such prompting may make people temporarily self-aware, which could dampen or change their subjective states (Silva, 2002). Certainly this is a risk with ESM, but it may be ameliorated as people become accustomed to the sampling procedure (typically 1–2 days). Of course, some individuals may take some time to become accustomed to sampling and therefore have the greatest risk of reactivity (i.e., people with lower working memory capacity who are less flexible at allocating attention).

Theoretical Complexities

ESM Is Different, Not Better

ESM has developed a reputation as the "gold standard" of self-report procedures, suggesting that ESM is inherently better than other types of self-reports and should be used whenever possible. But ESM is not a better self-report procedure; it is just different. ESM measures immediate subjective states that fluctuate in response to changing events and conditions, and constitute a form of episodic experience, in contrast to global self-reports, which measure people's generalized conceptualizations of themselves, a form of self-related semantic knowledge (Robinson & Clore, 2002a). ESM should not be used in all circumstances—only when seeking to measure episodic experience.

In fact, there may be circumstances when it is entirely *in*appropriate to use immediate ESM reports in a study. Asking people about their experiences in the present moment does not reveal how people organize and retain their representations of experience over time. Sometimes it is how people *remember* their experiences, not necessarily what *actually* happened across various moments, that is the stronger predictor of future behavior. For example, retrospective pain more than real-time pain has been shown to predict people's decisions about whether to undergo follow-up colonoscopies (Redelmeier, Katz, & Kahneman, 2003), and retrospective reports of enjoyment during a vacation, but not people's actual reported enjoyment during the vacation, have been shown to predict decisions about whether or not they would go on a similar trip in the future (Wirtz, Kruger, Napa Scollon, & Diener, 2003). These same effects may hold for other types of personality investigations, so it is important to consider what types of representations (immediate vs. retrospective vs. global) are best suited to the research question. Retrospective reports may be the "better measure" in studies in which people recollect their past to guide judgments and decisions.

ESM Does Not Always Eliminate the Influence of Memory

Many ESM studies use short-term retrospective reports (asking people about experiences *this morning*, these past *few hours*, *today*), which require retrieving past experiences from memory. Although short-term retrospective reports do not appear to be influenced by the belief-based reconstruction that occurs with longer-term retrospective reports, they can still be affected by the same retrieval biases that affect episodic memory, including "peak and end" effects as well as mood-congruent memory (for a discussion of short-term retrospective reports, see Robinson & Clore, 2002a, 2002b). Furthermore, these episodic biases will occur more when people are trying to recall fleeting states that are difficult to remember (like mood or pain), which is why immediate ESM reports are often used when sampling those states. Finally, even immediate reports can reflect stable beliefs if people are asked to report on some phenomenon to which they have no introspective access (e.g., self-perceptions of autonomic physiology, such as, "How fast is your heart beating?") (Robinson & Clore, 2002a).

ESM Is Bounded by the Conditions of Self-Report

ESM may bypass certain forms of memory bias, but it will not attenuate the issues associated with the self-report process, such as socially desirable responding or self-deception. Although the reporting conditions in ESM could possibly lessen socially desirable responding (people are outside the lab and away from cues reminding them that they are being evaluated on their responses), the reporting conditions are not likely to reduce self-deception or psychological defense, which are thought to color conscious experience. In fact, there is evidence that defensive processes affect ESM reports (Cutler, Larsen, & Bunce, 1996). As compared with those lower in defense, individuals higher in defense report less negativity and show more rigidity in their ESM reports. Findings like these remind us that ESM yields only that information a person is willing and able to represent in conscious awareness at the moment the report is made.

Future Directions

There are several exciting future directions both for the method itself and for applications to personality theory. In terms of method, computerized ESM should become even more accessible, as hardware costs remain low and software continues to be available without charge to the scientific community. We also anticipate a greater incorporation of indirect or performance-based measures into ESM. Already, researchers have the capacity to record response latency information and to administer a portable Implicit Association Test *in situ* (the P-IAT; Dabbs, Bassett, & Dyomina, 2003). In the future we may see other cognitive tasks incorporated into sampling, for example, measures of working memory or other indirect measures of cognitive processing. Thus *experience* sampling could incorporate *cognitive* sampling. Also exciting is the portable EAR (Electronically Activated Recorder) technique, which allows for the sampling of spontaneous audible expressions in daily life (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001; *www.tipware.com*). This technique, developed by Mehl and Pennebaker, allows researchers to extract regularities and patterns in spontaneous conversations otherwise unattainable through standard experience sampling.

There are several other methodology trends. Although free software is still available, ESM appears to be becoming increasingly commercialized. There are a growing number of high-end consultation practices that specialize in all stages of design and implementation, as well as smaller vendors selling more affordable "software solutions" for implementing ESM-type studies on PDAs, the Web, and via phone systems (interactive voice response, or IVR). We expect websystems and IVR to become increasingly popular platforms. In terms of data gathering, look for continual data transmission over wireless networks. Increased use of the Web, phones, and continual data transmission may have unforeseen costs, however, such as reducing personal contact between participants and researchers. This disconnect could present new challenges for maintaining participant rapport, response rates, and integrity of data.

In terms of personality theory, ESM will likely play a role in mapping the complex relations between episodic experiences and personality characteristics. The field appears to be moving beyond documenting a simple relation between states and traits and toward better understanding of how states configure to produce a characterization of the human personality. Especially exciting is the reinvigoration of the idea that some individuals are much more "traited" on certain characteristics than are others. For example, recent research has capitalized on sampling procedures to show stronger state–trait relations for certain individuals (i.e., those who are more habitual in their processing tendencies; Robinson & Cervone, 2006).

ESM could also aid in the development of an experience-based typology with links to important outcomes such as physical health, marital success, and well-being. The field already has the Big Five factor model for the structure of semantic personality beliefs; however, understanding of the major "state dimensions" or "episodic signatures" is still underdeveloped. ESM can capture these regularities, but not without appropriate and well-thought-out analyses to tease apart the patterns. Such teasing may require idiographic *P*-factor analysis or other sophisticated procedures. Again, it would also be judicious to go beyond description to test whether these finer-grained behavioral signatures (more so than general traits) are stronger predictors of cardiovascular reactivity, interpersonal successes, and so on.

Paradoxically, ESM—which is an explicit self-report procedure—may also stimulate work on the implicit aspects of personality. Many of our well-learned habits and processing tendencies lie outside of our awareness, yet nonetheless influence our spontaneous, situated reactions (Robinson, 2004). The key here is that these implicit aspects of personality typically influence reactions that are *spontaneous* *and situated*, which ESM captures. In fact, researchers are now using indirect measures in the lab to predict ESM reports and the results are very promising. For example, one study has shown that implicit attitudes about the self (as measured by an Implicit Association Test) predict variance in people's real-time affective experience, above and beyond what is predicted by self-reported attitudes alone (Conner & Barrett, 2005). Another study links implicit evaluative processing to real-time affect, showing that individuals who are fast to distinguish between neutral and negative stimuli in the lab have a higher level of negative daily affect in daily life (Robinson, Vargas, Tamir, & Solberg, 2004, Study 3). If this trend continues, immediate experience, measured by ESM, may be an important intersection between implicit personality processes and spontaneous experience.

Conclusion

Experience sampling is a powerful tool for realizing a modern-day idiographic and contextualized approach to personality. It enables measurement of dynamic *within-person patterns*, behavior *as it occurs*, and experiences as people *live their lives*. Although ESM should not be undertaken lightly without proper consideration of rationale and resources, the method itself is becoming increasingly feasible with gains in technology and a growing body of methodological guidelines. We hope that this chapter serves as a useful resource for practitioners in the science of personality.

Notes

1. Longitudinal designs in personality often involve test–retest situations separated by long time intervals. Although these designs reveal within-person change on the end points, they do not capture dynamic within-person change between the end points.
2. Historically, the terms *nomothetic* and *idiographic* were never intended to refer to methods in psychology. They were proposed by German philosopher Wilhelm Windelband as an alternative way to classify academic disciplines. The goal of nomothetic disciplines, like physics, was to develop general laws and principles (*nomo* in Greek = "law"); whereas the goal of idiographic disciplines, like history, was to understand a single event (or person) situated in time or place without generalizing (*idio*, Greek = "one's own, private") (Windelband, 1894/1998). Windelband made this distinction, in part, to classify the emerging field of experimental psychology as a nomothetic science inasmuch as its goal was to develop general laws about people. Over time, the terms have changed in meaning and are now used to refer to methods.
3. Some sampling software programs allow respondents to delay their reports if signaled at an inconvenient time. This option should be used cautiously because it can introduce sampling bias, where the reports reflect moments of convenience.
4. *Self-monitoring* refers to a method used in clinical psychology that is similar to event-based sampling. People are asked to monitor the occurrence of a behavior (thought, feeling, or action) and document the behavior by either simply noting that it occurred (using a counter or a paper-and-pencil record) or noting it and providing other information surrounding the experience. This procedure is used in two ways—to obtain an accurate picture of behaviors *in situ* and as a means of therapeutic change. When used in therapy, reactivity vis-à-vis the reduction of the behavior is considered a good thing—it indicates a successful intervention.

Recommended Readings

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