An Empirical Analysis of the Obtrusiveness of and Participants’ Compliance with the Electronically Activated Recorder (EAR)

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Abstract. In this article, the authors provide an empirical analysis of the obtrusiveness of and participants’ compliance with a relatively new psychological ambulatory assessment method, called the electronically activated recorder or EAR. The EAR is a modified portable audio-recorder that periodically records snippets of ambient sounds from participants’ daily environments. In tracking moment-to-moment ambient sounds, the EAR yields an acoustic log of a person’s day as it unfolds. As a naturalistic observation sampling method, it provides an observer’s account of daily life and is optimized for the assessment of audible aspects of participants’ naturally-occurring social behaviors and interactions. Measures of self-reported and behaviorally-assessed EAR obtrusiveness and compliance were analyzed in two samples. After an initial 2-h period of relative obtrusiveness, participants habituated to wearing the EAR and perceived it as fairly unobtrusive both in a short-term (2 days, \( N = 96 \)) and a longer-term (10–11 days, \( N = 11 \)) monitoring. Compliance with the method was high both during the short-term and longer-term monitoring. Somewhat reduced compliance was identified over the weekend; this effect appears to be specific to student populations. Important privacy and data confidentiality considerations around the EAR method are discussed.

Keywords: naturalistic observation, unobtrusive observation, behavioral observation, ecological momentary assessment, experience sampling, ambulatory assessment

Introduction

Psychological ambulatory assessment methods (AAMs) were developed to bypass methodological concerns around global and retrospective self-reports. Over the last 2 decades, they have successfully become the gold standard for capturing psychological aspects of everyday life (for reviews see Bolger, Davis, & Rafaeli, 2003; Fahrenberg, Myrtek, Pawlik, & Perrez, 2007; Piasecki, Hufford, Solhan, & Trull, 2007; Stone, Shiffman, Atienza, & Nebeling, in press). With self-report-based AAMs, participants are prompted several times a day and asked to provide instant reports of their momentary experiences, behaviors, or interactions. The impact that AAMS have had on psychological research is hard to overstate. Ambulatory assessment has enabled researchers to capture psychological phenomena directly where they naturally occur – in the flow of people’s mundane daily lives (Ebner-Priemer, 2006; Fahrenberg & Myrtek, 2001; Perrez, Schoebi, & Wilhelm, 2000; Wilhelm & Perrez, 2004).

From a multimethod perspective, however, momentary and retrospective self-reports share common method variance because both methods derive their data from participants’ reports of their subjective experiences and perceptions (Eid & Diener, 2005). Therefore, some of the concerns raised for retrospective self-reports potentially also apply to momentary self-reports (e.g., self-deception, impression management, Paulhus & Vazire, 2007; mood, salience, or context effects, Takarangi, Garry, & Loftus, 2006). To further expand the ambulatory assessment tool box and to further decrease method overlap in real-world assessment, it would be desirable to complement momentary self-report data with momentary observational and behavioral data (cf. Goodwin, Velicer, & Intille, in press). In psychology, very few studies have employed person-centered naturalistic observation methods.

Barker and Wright (1951) pioneered a naturalistic observation method in their famous case study of the 7-year-old Raymond who observers followed over an entire day. In the early 1990s, Craik (2000) revived the naturalistic observation approach with his Lived Day Analysis, an observational method that captures individuals in the natural pursuit of their lives by following them around with a handheld video camera. In creating permanent audio-visual records of a person’s day, it constituted a major methodological improvement over Barker and Wright’s behavior specimen record. In observing people directly in their natural habitat it preserved the original spirit of One Boy’s
Day. However, like Barker and Wright’s method, which resulted in hundreds of pages of field notes per person per day, Lived Day Analysis accrued many hours of fascinating but analytically overwhelming video footage, practically constraining its use to ideographic analyses. In addition, the method is naturalistic but not unobtrusive because a research team following participants around with a video camera inevitably induces reactivity from the target and people in the target’s environment.

A Tool for the Naturalistic Observation of Daily Life: The Electronically Activated Recorder

Over the last 8 years, we have developed the electronically activated recorder (EAR) (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001), a psychological AAM that samples (acoustic) observations of participants in the natural pursuit of their daily lives.

What is the EAR?

Technically, the EAR is a modified portable audio-recorder that periodically records brief snippets of ambient sounds. Participants wear it attached to their belt or in a purse-like bag while going about their daily lives. In tracking moment-to-moment ambient sounds, it yields acoustic logs of people’s days as they naturally unfold. In providing authentic, real-life, observational data about people’s lived days it follows in the footsteps of Barker and Wright (1951) and Craik (2000). In sampling only a fraction of the time instead of recording continuously it makes large-scale, nomothetic naturalistic observation studies possible (e.g., Mehl, Vazire, Ramirez-Esparza, Slatcher & Pennebaker, 2007).

The EAR was initially developed as an analog recording system using a generic microcassette recorder that was triggered by a controller chip (Mehl et al., 2001). In 2001, this system was replaced by a second generation EAR system based on a digital voice recorder (Mehl, Gosling, & Pennebaker, 2006). Most recently, in 2005, the digital EAR system was replaced by a third generation EAR system that is software-based and runs on commercial PDAs (Pocket PCs). The PDA-based EAR has been extensively pilot-tested and runs with high reliability.

What Information Can Be Derived from the EAR Recordings?

Researchers can adopt either a psychological rating or a behavioral coding approach to deriving psychological information from the sampled ambient sounds (Sillars, 1991). With the psychological rating approach, expert raters listen to the full set or selected segments of participants’ sound files and judge the degree to which the sound files indicate the presence of a psychological construct of interest. For example, a group of relationship experts could listen to participants’ sound files and – on the basis of 2 days of monitoring or a certain number of captured conversations – rate the participants regarding their relationship satisfaction, social support, expressed emotions, or protective buffering (Kerig & Baucom, 2004). In this case information is extracted at a molar, psychological level. Reliability can be determined from the degree of consensus among the expert raters, and the construct validity of the ratings can be determined through comparisons with established measures of the construct (e.g., self-reports, spousal/informant reports).

In our research, we have primarily worked with behavioral codings. With this approach information is extracted at the molecular level of the raw behavior. Trained coders listen to all of a participant’s EAR recordings and code each sound file according to a standardized coding system. Over the last years, we have developed and refined the Social Environment Coding of Sound Inventory (SECSI; Mehl & Pennebaker, 2003b, Mehl et al., 2006) to capture basic aspects of participants’ moment-to-moment social behaviors, environments, and interactions. The SECSI comprises four category clusters: (1) the person’s current location (e.g., in apartment, outdoors, in transit), (2) activity (e.g., listening to music, on the computer, eating), (3) interaction (e.g., alone, talking, on the phone), and (4) mood (e.g., laughing, crying, sighing). The raw codings are converted into time-use estimates by calculating the percentage of a person’s waking EAR recordings in which a category applied (e.g., percentage of sound files in which the participant was talking or listening to music). The coders generally also transcribe all of the participants’ utterances that the EAR captured. The verbatim transcripts can then be submitted to a quantitative text analysis (Mehl, 2005).

We routinely obtain estimates of intercoder reliability from a training set of EAR recordings that all coders involved in a given study code independently. Consistent with the specific, concrete, and behavioral nature of the codings (e.g., “talking” or “laughing”), the intercoder reliabilities for the currently 32 SECSI categories tend to be high. In a recent study, intraclass correlations based on a two-way random effects model, ICC(2,k), exceeded .70 for all categories except “reading” (r = .12). Eighteen categories yielded intraclass correlations that were equal to or exceeded r = .85 (Mehl et al., 2006). Comparable intercoder reliabilities were obtained in two other EAR studies (Mehl & Pennebaker, 2003a,b).

We recently adapted the SECSI for the use in cross-cultural research. In a binational EAR study, we compared the social lives of Mexicans in Mexico and Americans in the U.S. Although Mexicans reported being less sociable than Americans in a traditional personality questionnaire, the EAR captured them behaving more sociably as measured
by the time they spent with others and in noninstrumental, social conversations (Ramírez-Esparza, Mehl, Álvarez Bermúdez, & Pennebaker, 2007). It is a critical advantage of the coding approach that behavioral codings at the molecular level (e.g., “talking”) are less susceptible to culture-specific interpretations than psychological ratings at the molar level (e.g., degree of relationship satisfaction). Further, the behavioral coding approach yields measures that are based on a nonarbitrary, naturally meaningful, real-life relevant metric: act frequencies of daily behavior (e.g., percentage of time talking, laughing, or watching TV; cf. Kazdin, 2006).

**What Are the Ethical and Legal Considerations Around the EAR Method?**

Recording snippets of ambient sounds from people’s environments raises ethical and legal questions. EAR studies conducted in our lab routinely implement a series of safeguards to protect participants’ privacy and to ensure the confidentiality of the data (Mehl et al., 2001; Mehl & Pennebaker, 2003b). We have found these safeguards to be highly effective at alleviating concerns that participants may have about the method. First, the EAR is programmed to record less than 5% of the time (e.g., 30 s every 12.5 min) leaving more than 95% of their days unrecorded and private in the first place. Second, the recordings are kept short; 30 sec recordings are long enough to reliably code the sound files for basic behavioral information, yet they are short enough to capture little contextualized personal information. Finally, and most importantly, all participants have the opportunity to listen to their EAR recordings and delete parts they do not want on record before the investigators have access to the data. In a recent study, 19 out of 96 participants (19.8%) reviewed their recordings, but only three erased sound files (10 in total; Mehl et al., 2006).

However, the more serious concerns revolve not around the participants themselves but around bystanders who are not directly involved in the study but whose behaviors are captured by the EAR. In the United States, there are few restrictions about recording people’s utterances in public places. The situation concerning the recording of private conversations is more ambiguous. In most parts of the U.S. (including Texas and Arizona where the studies from our lab have been conducted), recordings can be made legally if at least one of the interactants has knowledge of the recording. A small number of states only allow recordings if all interactants know about the recording. Even in the most legally restrictive states, however, unauthorized recordings are only problematic if they are personally identifiable.

In EAR studies from our lab, participants are encouraged to wear the microphone visibly and to openly mention the EAR in conversations with others. Irrespective of such notification, anonymity of other people’s utterances is of paramount importance, because their behavior is collected without informed consent. As mentioned above, the brief recording snippets minimize the chance that personally identifying information about a third person is captured (e.g., a full name). As further protections, the sound files are coded and transcribed by research staff that are explicitly trained and certified for conducting research with human subjects. In the coding process, then, any identifying information is omitted from the transcripts. Finally, as mentioned above, participants have the option of erasing any sound file before the researchers can access them. It is, thus, highly unlikely that the EAR paradigm as we have established it violates privacy rights of people who are inadvertently recorded.

Despite these safeguards to protect the privacy of participants, the anonymity of nonparticipants, and the confidentiality of the collected data, EAR researchers must be aware of the ethical implications of recording others. Through careful instructions and informed consent procedures, brief recording periods, thorough coder training, and the removal of identifying information, adherence to ethical and legal standards for research can be ensured.

**What Are the Capacities and Limitations of the EAR Method?**

As a naturalistic observation method, the EAR can capture large amounts of vivid information about a person’s ecological behavior and interactions over a period of several days. Yet, through its sampling strategy, the amount of recorded material is kept manageable. Because the most recent EAR system is software-based (running on a commercial Pocket PC), researchers can now freely adjust the recording schedule to their study needs (e.g., 30 s every 12.5 min, 10 min every 2 h with a blackout period from midnight to 6 a.m.). This way, the method has become suited for an array of research questions in social/personality, cultural, and health psychology. Undoubtedly, though, the method’s unique strength lies in tracking spontaneous real-world interactions. Traditional, self-report based AAMs can assess a range of features of daily interactions; the EAR, however, objectively and permanently records exactly what the participants said—word by word. In this manner, the method is of particular interest for researchers in the field of communication and language use (Mehl et al., in press).

The EAR, however, also has limitations. First and foremost, it only captures people’s acoustic social lives. Other undoubtedly important sensory channels are not recorded. Further, constraints exist on where the method can be used. Although we have seen participants get quite creative in how they get their daily activities on record (one participant took the EAR to her tae-kwon-do class), the device cannot be taken everywhere. We explicitly instruct participants not to wear the EAR device when its functioning is in jeopardy (e.g., when taking a shower or playing sports). Also, in cer-
In certain employment settings, participants may not be allowed to wear the device at work (e.g., as a bank teller). Finally, participants tend to have their idiosyncratic reasons for not wanting to wear the device in certain situations (one participant informed us she did not want us to hear her singing on the tape). Because it is unreasonable to assume that participants wear the EAR continuously for the entire day, it is important to track noncompliance. As is generally the case with AAM research, the quality of an EAR study depends on the degree to which participants feel actively involved in the research (Green, Rafaeli, Bolger, Shrout, & Reis, 2006). Therefore, we routinely let participants know that the “best” participant is not the one that reports having worn the device nonstop but rather the one that accurately indicates (in a provided diary) times when it was not possible to wear the device. That way (and through coding noncompliance directly from the sound files), researchers can get a grasp on noncompliance and gain confidence in the validity of their data.

An Empirical Analysis of the Obtrusiveness of and Participants’ Compliance with the EAR

The purpose of this article is to conduct an empirical investigation into two important methodological questions around the method: (1) How obtrusive is the EAR in daily life? and, (2) to what extent do participants comply with wearing the EAR? The analyses are based on two archival data sets that were collected between 2001 and 2002 at the University of Texas at Austin. Details about the procedures and findings of the original studies are provided elsewhere (Mehl, 2006; Mehl et al., 2006, Mehl & Pennebaker, 2003a).

The empirical analyses sought to address these two research questions using both self-report measures and behavioral markers of obtrusiveness and compliance. The analyses further sought to provide (1) information about the general level of EAR obtrusiveness and compliance and (2) a fine-grained picture of how obtrusiveness and compliance changed over the course of a short-term (48-h) and longer-term (10–11-day) monitoring.

Method

Participants

Sample 1 consisted of 110 undergraduate students who wore the EAR for 48 h on weekdays (for details see Mehl et al., 2006). Sample 2 consisted of 14 undergraduate and graduate students who wore the EAR continuously for 10–11 days surrounding September 11, 2001. Six of the participants started wearing the EAR on Sept. 10; five more students were recruited on Sept. 11 (for details see Mehl & Pennebaker, 2003a). The data for Sample 1 was collected with the (at that point) just developed digital EAR system. Because of technical difficulties in the initial phase of use, 14 Sample 1 participants had extensive missing data and were excluded from the analyses. In Sample 2, three participants had more than one full day of missing data and were excluded from the analyses. The final number of participants in Sample 1 was 96 (47 females) and 11 in Sample 2 (7 females). All participants were informed about our EAR privacy and confidentiality policies, including the opportunity to review recordings and erase any part they did not want the researchers to hear.

Assessment of EAR Obtrusiveness

Self-Reported Obtrusiveness

Participants in both studies completed an eight-item questionnaire about their experiences with the EAR. On a 5-point scale ranging from 1 (not at all) to 5 (a great deal), they rated the obtrusiveness of the EAR for themselves (e.g., “To what extent were you aware of the EAR?”; “To what degree did the EAR impede on your daily activities?”) and people around them (e.g., “To what degree were people around you aware of the EAR?”; “To what degree did the EAR influence the behavior of people around you?”). The complete list of items is shown in Table 1. A principal component analysis based on participants from both samples extracted three factors with initial eigenvalues exceeding 1 (3.97, 1.62, 1.18). On the basis of the scree test and the interpretability of the solutions, a two-factor solution was retained and accounted for 57.4% of the variance (sums of squared loadings after varimax rotation: 2.48, 2.11). The items were then aggregated into two scales according to their highest absolute loadings: Obtrusiveness for participants (five items, $\alpha = .75$) and obtrusiveness for bystanders (three items, $\alpha = .73$). The two scales were correlated $r = .29, p < .01$.

Behaviorally Assessed Obtrusiveness

As a behavioral measure of obtrusiveness, the coders counted the number of sound files in which participants mentioned the EAR with others. This raw count was converted into the percentage of participants’ conversations that mentioned the EAR (i.e., the number of sound files in which the participant was talking about the EAR divided by the total number of recorded sound files in which the participant was talking to others multiplied by 100). Across both samples, this behavioral obtrusiveness marker was not reliably related to participants’ reports of how obtrusive the method was for them ($r = .11, ns$) but positively related to their reports of how obtrusive the method was for bystanders ($r = .21, p < .05$).
Assessment of EAR Compliance

Self-Reported Compliance

Participants further indicated what percentage of the day (based on their time awake) they were not wearing the EAR. Self-reported noncompliance was positively correlated with how obtrusive participants perceived the method to be for themselves, \( r = .35, p < .01 \), and for bystanders, \( r = .22, p < .05 \). Self-reported noncompliance was unrelated to behaviorally assessed obtrusiveness, \( r = .09 \).

Behaviorally Assessed Compliance

As a behavioral measure of compliance, the coders marked when participants were not wearing the EAR. “Not wearing the EAR” was coded if over a 30 s recording period no ambient sounds whatsoever, that is not even sounds of breathing or clothes rubbing against the microphone, were recorded. The raw codings were converted into the percentage of time participants were not wearing the EAR (i.e., the number of sound files coded as “not wearing the EAR” divided by the total number of recorded sound files multiplied by 100). This behavioral noncompliance measure was strongly correlated with participants’ reported noncompliance, \( r = .45, p < .01 \), and unrelated to participants’ reported obtrusiveness for themselves, \( r = .09 \), and for others, \( r = .08 \). Behavioral noncompliance and behavioral obtrusiveness were correlated \( r = .25, p < .01 \).

Results

How Obtrusive Was the EAR in Participants’ Daily Lives?

General Obtrusiveness

Overall, participants’ obtrusiveness ratings were comparable for the two samples (see Table 1). When participants wore the EAR for the first time they reported being moderately aware of it and feeling somewhat impeded by it in their daily activities. Yet, the reported degree of EAR-induced behavioral and conversational change was minimal. According to the participants’ perceptions, bystanders experienced a slightly higher degree of awareness of the method (\( M = 3.2 \) vs. \( M = 2.9 \), \( p < .01 \); Item 1 compared to Item 6 using the combined data from both samples) and were also somewhat more affected by it in their behavior (\( M = 2.1 \) vs. \( M = 1.6 \), \( p < .01 \); Item 4 compared to Item 8 using the combined data from both samples) than the participants themselves. It is possible that this disparity in perceived impact is driven by the differential knowledge that participants and bystanders had of the study’s privacy and confidentiality policies.

Table 1. Descriptive statistics for self-reported and behaviorally assessed EAR obtrusiveness and compliance

<table>
<thead>
<tr>
<th></th>
<th>Sample 1 (N = 96)</th>
<th>Sample 2 (N = 11)</th>
<th>t test</th>
<th>( p &lt; )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported obtrusiveness for participants: To what degree . . .</td>
<td></td>
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<tr>
<td>. . . were you generally aware of the EAR?</td>
<td>2.9 (1.0)</td>
<td>2.6 (0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>. . . did you feel uncomfortable wearing the EAR?</td>
<td>2.0 (1.0)</td>
<td>1.8 (1.2)</td>
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<tr>
<td>. . . did the EAR impede you in your daily activities?</td>
<td>1.9 (0.9)</td>
<td>1.6 (0.7)</td>
<td></td>
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<tr>
<td>. . . did the EAR change your actual behavior?</td>
<td>1.6 (0.8)</td>
<td>1.5 (0.7)</td>
<td></td>
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<tr>
<td>. . . did the microphone influence your way of talking?</td>
<td>1.5 (0.9)</td>
<td>1.5 (1.0)</td>
<td></td>
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<tr>
<td>Scale</td>
<td>2.0 (0.7)</td>
<td>1.8 (0.5)</td>
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<tr>
<td>Self-reported obtrusiveness for bystanders: To what degree . . .</td>
<td></td>
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<tr>
<td>. . . were people around you aware of the EAR?</td>
<td>3.3 (1.1)</td>
<td>2.8 (1.0)</td>
<td></td>
<td></td>
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<tr>
<td>. . . did you talk to people around you about the EAR?</td>
<td>3.6 (1.0)</td>
<td>2.9 (1.0)</td>
<td>.05</td>
<td></td>
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<tr>
<td>. . . did the EAR influence the behavior of people around you?</td>
<td>2.1 (1.1)</td>
<td>2.1 (0.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scale</td>
<td>3.0 (0.9)</td>
<td>2.6 (0.9)</td>
<td></td>
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<tr>
<td>Behaviorally assessed obtrusiveness</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Percent of conversations about the EAR</td>
<td>3.6 (4.0)</td>
<td>2.6 (2.4)</td>
<td></td>
<td></td>
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<tr>
<td>Self-reported compliance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of time awake not wearing the EAR</td>
<td>22.5 (16.4)</td>
<td>11.7 (6.9)</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>Behaviorally assessed compliance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of time not wearing the EAR</td>
<td>9.2 (14.2)</td>
<td>1.9 (3.6)</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

Note. All self-report ratings were made on a 5-point Likert scale with 1 = “not at all” and 5 = “a great deal”; self-reports and behavioral codings are based on wearing the EAR for two days (Sample 1) and continuous EAR monitoring for 10–11 days (Sample 2).
The data for behaviorally-assessed obtrusiveness are consistent with the picture that emerged from participants’ self-reports. On average, participants mentioned the method with others in about 3% of their conversations. This suggests that both they and people around them were to some extent aware of but not notably bothered by the EAR. Interestingly, despite the fact that Sample 2 participants received financial compensation ($10 per day) and Sample 1 participants received only course credit for their participation, self-reported and behaviorally-assessed obtrusiveness was comparable for the two samples. This suggests that monetary incentives may not be effective at reducing the extent to which participants are aware of and feel impeded by the method in the pursuit of their daily lives.

Changes in Obtrusiveness over Short-Term Monitoring

To what extent did participants habituate to wearing the EAR in the hours after they received it? Panel A of Figure 1 shows how the behavioral marker of obtrusiveness changed over the course of a 2-day EAR monitoring (Sample 1). The x-axis shows the time in hours awake after receiving the EAR. In order to base the statistics on the entire sample, the analyses were restricted to 23 h of net monitoring; 62 participants provided more than 32 h, and 14 participants more than 38 h of daytime monitoring. For this analysis, we used the percentage of time talking about the EAR (i.e., the number of sound files in that hour in which the participant was talking about the EAR divided by the total number of recorded sound files in that hour multiplied by 100) as metric on the y-axis (instead of the percentage of conversations about the EAR; several participants did not talk for several hours; therefore, the number of conversations could not be used in the denominator); the y-axis in Panel B represents the percentage of participants’ captured conversations that mentioned the EAR.

Figure 1. Behaviorally assessed short-term and longer-term obtrusiveness of the EAR method: changes in talking about the EAR over a 2-day (Panel A; N = 96) and 10/11-day (Panel B; N = 11) monitoring period. Note: Error bars represent standard deviations. For maximum use of the available data, the y-axis in Panel A represents the percentage of time participants talked about the EAR (not the percentage of conversations that mentioned the EAR; several participants did not talk for several hours; therefore, the number of conversations could not be used in the denominator); the y-axis in Panel B represents the percentage of participants’ captured conversations that mentioned the EAR.
Changes in Obtrusiveness over Longer-Term Monitoring

How obtrusive was the EAR for participants over the course of their 10–11 days of monitoring? Panel B of Figure 2 shows how the behavioral marker of obtrusiveness changed for the 11 students that wore the EAR surrounding September 11, 2001. The x-axis depicts the time of wearing the EAR aggregated for reliability purposes into 2-day units. The y-axis indicates the percentage of participants’ conversations that mentioned the EAR. Consistent with a general habituation to the method, the frequency of EAR conversations decreased monotonously over the course of the entire monitoring period. Initially, participants mentioned the method in about 5% of their daily interactions. This percentage dropped below 2% during the second half of the monitoring. The drop in mean level was further accompanied by decreases in the standard deviations. This suggests that initial idiosyncratic reactions to the method were gradually overridden by a general habituation response for almost all participants.

How Well Did Participants Comply with Wearing the EAR?

General Compliance

Sample 1 participants indicated not having worn the EAR on average about 23% of their time awake (see Table 1). Self-reported compliance was higher in Sample 2 (M = 12%). A similar picture emerged for the behavioral marker of noncompliance; coded ‘not wearing the EAR’ was more frequent in Sample 1 (M = 9%) than in Sample 2 (M = 2%). The fact that Sample 2 participants received financial compensation points to the possibility that monetary incentives, although ineffective at reducing the method’s obtrusiveness, may have the potential to increase compliance. Also, wearing the EAR in the aftermath of a national disaster may have been perceived as more meaningful and important than wearing the EAR in times of normal life and as a result facilitated compliance.

It is interesting that in both samples, self-reported compliance was lower than behaviorally-assessed compliance. It is conceivable that EAR coded noncompliance to some extent underestimated actual noncompliance (e.g., when the EAR was not worn but ambient sounds were picked up). Yet, the fact that participants readily acknowledged times they did not wear the EAR can be considered an indirect compliance indicator in and of itself. The substantial correlation between self-reported and behaviorally-coded noncompliance (r = .45, p < .01) suggests that participants considered deceptive self-presentation unnecessary.

Changes in Compliance over Short-Term Monitoring

How did participants’ compliance vary over the 2-day monitoring? Panel A of Figure 2 shows changes in the percentage of time coded as ‘participants not wearing the EAR’. After an initial period of very high compliance, non-compliance increased gradually with decreasing slopes and reached a plateau around 10–12% behaviorally-coded non-compliance after around 12 h of wearing the EAR.

Changes in Compliance over Longer-Term Monitoring

How did Sample 2 participants’ compliance change over the 10–11-day monitoring? As depicted in Panel B of Figure 3, the number of sound files coded as ‘not wearing the EAR’ remained constant at about 2% over the entire monitoring period. However, over the weekend participants were somewhat less compliant with wearing the device. Coded noncompliance temporarily rose to about 5% with the standard deviation also increasing to about four times the magnitude of standard deviations on weekdays.

Discussion

As a naturalistic observation sampling method, the EAR fills a methodological gap in psychological research. It supplements the dominant “insider” perspective of the self with the empirically underexplored, yet theoretically and practically important “outsider” perspective of a detached observer. In this way, it complements traditional self-report-based AAMs in the assessment of psychosocial aspects of daily life. However, two important questions around the method concern (1) the degree to which it is perceived as unobtrusive, and (2) the extent to which participants comply with wearing the device in the natural pursuit of their daily lives. In an empirical study based on two archival data sets, we analyzed self-report and behavioral measures of EAR obtrusiveness and compliance in two different samples.

Overall, the findings regarding the obtrusiveness of the method paint the following picture: Immediately after receiving the EAR, participants went through a brief period of heightened self-awareness in which conversations about the EAR were frequent. Within 2 h of wearing the device, however, most participants habituated to the method and rarely mentioned it with others thereafter. This habituation effect was found not only for the relatively short 2-day monitoring (Sample 1) but also for the extended 10–11-day monitoring around September 11, 2001 (Sample 2). In the later sample, some individuals initially talked (and, therefore, thought) about the method more than others; yet after
5–6 days wearing the device, virtually all participants had adjusted to it and barely mentioned it anymore in their daily conversations. Both the initial period of heightened awareness and influence of the EAR and the subsequent habituation found in this study are consistent with prior research on the obtrusiveness of observational research (Christensen & Hazzard, 1983).

The study further yielded the following findings regarding participants’ compliance: Among the participants who went through a short-term 2-day monitoring, compliance was very high in the first hours after they had received the EAR. Noncompliance gradually increased over time and leveled off at about 10–12% on the second day of monitoring. This compliance is comparable to the compliance reported for traditional AAMs (Bolger et al., 2003; Green et al., 2006; Stone, Shiffman, Schwartz, Broderick, & Huffman, 2003). Longer-term compliance among the 11 Sample 2 participants was high for at least 6 days. After that, variability in noncompliance increased suggesting that the tolerance threshold was reached for some participants. Although the study does not permit strong conclusions about whether monetary incentives can affect EAR obtrusiveness and compliance, the data suggest that financial compensation may do little to reduce the method’s obtrusiveness but may have the potential to increase compliance.

Interestingly, compliance rates were somewhat reduced (yet reasonably high) over the weekend. Because of the unique timing of the data collection for Sample 2, it is not possible to tell whether this drop in compliance was related to September 15 and 16 being the first weekend after the 9/11 attacks and, therefore, likely a time of personal coping (Mehl & Pennebaker, 2003a) or whether it was related to aspects of participants’ schedules that made wearing the EAR more bothersome over the weekend. Our speculation is that the compliance drop over the weekend may be specific to (undergraduate) student populations and their presumably active weekend social life. In an ongoing study we find high method acceptance and excellent compliance with wearing the EAR over the weekend in a community sample of rheumatoid arthritis patients.

This study was subject to at least three limitations that call for a cautious interpretation of the results. First, because of the unforeseen nature of the original project (which happened to start on September 10, 2001, the day...
before the attacks on the World Trade Center), the sample size for Sample 2 was very small. The small sample size can critically affect the reliability of the estimates and render the analyses (e.g., for the longer-term compliance and obtrusiveness) prone to outliers. Second, the two EAR samples on which the analyses are based were exclusively comprised of university students. Therefore, it is not clear to what extent the relatively low obtrusiveness and high compliance generalizes to other populations with different weekly and daily schedules. We are currently running two studies with community samples that will ultimately allow us to address this question. Third, both EAR samples were collected in the United States. It is possible that participants from other countries have unique privacy needs and concerns about the method. Potentially, then, different safeguards may be needed to address these concerns and to successfully use the method in other countries. Also, adjustments to the default protocol may be required to comply with federal regulations in other countries. Our EAR study in Mexico (Ramirez et al., 2007) was a first step toward addressing these issues but, clearly, these questions can only be adequately addressed to the extent that the method will gradually be adopted by researchers in other countries.

Finally, it is important to note that the definition of unobtrusiveness in EAR research differs somewhat from traditional conceptions of unobtrusive measurement (cf. Fritsche & Linneweber, 2006). Bochner (1979) summarized concisely that “the essence of the unobtrusive method is that subjects are not aware that they are participating in a psychological experiment, usually unaware that their behavior is being measured, and generally unaware that they are even being observed” (p. 33). In EAR studies, participants are explicitly informed that they are part of a study (an indispensable part of informed consent) and are, therefore, a priori aware that their behavior is being intermittently recorded. Yet, they are oblivious to the precise timing of the recordings, which leaves them effectively unaware of exactly when and which of their behaviors are being observed.

Because the EAR seeks to achieve unobtrusiveness through habituation (instead of a priori unawareness of the act of observation), it is by nature susceptible to measurement-induced reactivity (Fritsche & Linneweber, 2006). In other words, it is possible that participants are avoiding or modifying certain behaviors to control their records. Exactly what kinds of behaviors are subject to such reactivity and to what extent should be the topic of future research. The findings of the analyses provided here combined with our own experiences from extensive self-experimentation with the method suggest that, for practical purposes, reactivity to the EAR monitoring is relatively low to the extent that the research focuses on mundane behaviors that could potentially be observed by other people. Therefore, we argue that for the assessment of such daily behaviors the method can be considered relatively unobtrusive.

To summarize, we believe the EAR method has unique potentials for researchers in different fields of psychology. Currently, it is the only available methodology that allows the sampling of person-centered, observational data in people’s natural environments. Necessarily, some of the data that the EAR provides overlaps with what is obtained by traditional psychological AAMs (Fahrenberg & Myrtek, 2001). It will be an important task for future research to combine the observational EAR method with traditional, self-report based and other behavioral and physiological AAMs (Ebner-Priemer, 2006; Goodwin et al., in press). Such a merger of different AAMs bears the potential of subjecting people’s daily lives to a multimethod assessment that covers the full spectrum of methods that is available to psychologists and other social and behavioral scientists. Clearly, there are technological and methodological challenges to be resolved; yet, the vision of being able to collect several channels of rich, ecological data online, directly from the natural stream of people’s lives is powerful. Ultimately, it is only be through the systematic use of multiple methods that a comprehensive picture of the psychological implications of human social life will emerge.

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