

New Evaluation of the Electronically Activated Recorder (EAR): Obtrusiveness, Compliance, and Participant Self-Selection Effects

Joseph H. Manson^{1*}, Megan L. Robbins²

¹Anthropology, University of California, Los Angeles, USA, ²Psychology, University of California, Riverside, USA

Submitted to Journal:
Frontiers in Psychology

Specialty Section:
Personality and Social Psychology

ISSN:
1664-1078

Article type:
Original Research Article

Received on:
04 Feb 2017

Accepted on:
12 Apr 2017

Provisional PDF published on:
12 Apr 2017

Frontiers website link:
www.frontiersin.org

Citation:
Manson JH and Robbins ML(2017) New Evaluation of the Electronically Activated Recorder (EAR): Obtrusiveness, Compliance, and Participant Self-Selection Effects. *Front. Psychol.* 8:658.
doi:10.3389/fpsyg.2017.00658

Copyright statement:
© 2017 Manson and Robbins. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution and reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Provisional

New Evaluation of the Electronically Activated Recorder (EAR): Obtrusiveness, Compliance, and Participant Self-Selection Effects

1 Joseph H. Manson^{1*}, Megan L. Robbins^{2*}

2 ¹Department of Anthropology and Center for Behavior, Evolution, and Culture, University of
3 California, Los Angeles, CA, USA

4 ²Department of Psychology, University of California, Riverside, CA, USA

5 * **Correspondence:**

6 Joseph H. Manson

7 jmanson@anthro.ucla.edu

8

9 Megan L. Robbins

10 megan.robbins@ucr.edu

11 **Keywords:** naturalistic observation, experience sampling, Electronically Activated Recorder,
12 HEXACO, Conscientiousness

13

14 **Abstract**

15 The Electronically Activated Recorder (EAR) is a method for collecting periodic brief audio snippets
16 of participants' daily lives using a portable recording device. The EAR can potentially intrude into
17 people's privacy, alter their natural behavior, and introduce self-selection biases greater than in other
18 types of social science methods. Previous research (Mehl & Holleran, 2007, hereafter M&H) has
19 shown that participant non-compliance with, and perceived obtrusiveness of, an EAR protocol are
20 both low. However, these questions have not been addressed in jurisdictions that require the consent
21 of all parties to recording conversations. This EAR study required participants to wear a button
22 bearing a microphone icon and the words "This conversation may be recorded" to comply with
23 California's all-party consent law. Results revealed self-reported obtrusiveness and non-compliance
24 were actually lower in the present study than in the M&H study. Behaviorally assessed non-
25 compliance did not differ between the two studies. Participants in the present study talked more about
26 being in the study than participants in the M&H study, but such talk still comprised <2% of sampled
27 conversations. Another potential problem with the EAR, participant self-selection bias, was
28 addressed by comparing the EAR volunteers' HEXACO personality dimensions to a non-volunteer
29 sample drawn from the same student population. EAR volunteers were significantly and moderately
30 higher in Conscientiousness, and lower in Emotionality, than non-volunteers. In conclusion, the EAR
31 method can be successfully implemented in at least one all-party consent state (California). Interested
32 researchers are encouraged to review this procedure with their own legal counsel.

33 **1 Introduction**

34 Psychologists' common reliance on (1) decontextualized behavioral responses to laboratory
35 manipulations, and (2) global self-report instruments, limits the ecological validity of inferences

36 about social processes and personality variation (Funder, 2001; Rozin 2001). Growing recognition of
37 this problem has inspired the development and evaluation of a variety of methods for systematically
38 sampling human behavior outside the laboratory (Mehl & Conner, 2012; Robbins, in press). One
39 such method, the Electronically Activated Recorder (EAR; Mehl, Pennebaker, Crow, Dabbs, & Price,
40 2001; Mehl & Robbins, 2012; Mehl, Robbins, & Carey, 2014) unobtrusively collects periodic brief
41 audio snippets of people’s daily lives, using a portable recording device that participants wear
42 attached to their clothes during their waking hours. Though the function of the EAR—to acoustically
43 sample social environments—has remained consistent since 2001, the technology used to make the
44 recordings has evolved. The EAR has progressed from digital tape recorders to the current iPod
45 Touch devices using the “iEAR” app (Mehl, in press). As technology has progressed, the legal
46 landscape has also adapted to address the potential for others to be recorded on smartphones and
47 other devices, such as iPods. Because of this, methods such as the EAR need to be adjusted to
48 comply with laws (Robbins, in press). This study sought to examine how one such adjustment for the
49 EAR—a button participants wear to notify others they may be recorded—may alter its obtrusiveness,
50 participant compliance, and self-selection bias.

51 As a naturalistic, ecological method, the EAR resembles experience sampling methods (ESM:
52 Csikszentmihalyi, Larson, & Prescott, 1977; Conner, Tennen, Fleeson, & Barrett, 2009). The two
53 methods differ, however, in the perspectives they capture (Mehl & Robbins, 2012). ESM
54 participants are periodically prompted to report on their momentary cognitions, emotions, behaviors,
55 and/or situations. Thus, ESM data represent the self’s subjective, experiential perspective, and
56 therefore ESM methods are appropriate when research questions pertain to this perspective. ESM
57 data are susceptible to some of the same limitations (e.g. impression management) as the more
58 commonly used global or retrospective self-report instruments. In contrast, the EAR method captures
59 a bystander’s perspective on behavior. A wide variety of behavioral variables, including speech
60 content, can be reliably coded from EAR-generated recordings. Mehl and Pennebaker (2003) found
61 substantial inter-rater reliability and within-participant temporal stability in variables pertaining to
62 participant location, activity (e.g. amusement, attending lecture), social interaction (e.g. talking to
63 others, laughing), and language use as measured by the Linguistic Inquiry and Word Count software
64 (LIWC; Pennebaker, Francis, & Booth, 2001). Self-reported major personality dimensions are
65 correlated in predictable ways with some EAR-measured variables (e.g., Extraversion negatively
66 correlated with percentage of time spent alone; Mehl, Gosling, & Pennebaker, 2006).

67 In recent years, a number of other research questions have been addressed using EAR-generated
68 data, usually in conjunction with self-report measures. These questions include the relative accuracy
69 of self- and other-reports of daily behavior (Vazire & Mehl, 2008), debunking myths about sex
70 differences in talkativeness (Mehl, Vazire, Ramírez-Esparza, Slatcher, & Pennebaker, 2007),
71 individuals’ and couples’ means of coping with chronic illness (Robbins et al., 2011; Robbins,
72 López, Weihs, & Mehl, 2014), interpersonal conflict and physical health (Tobin et al., 2015), and
73 social behavior associated with borderline personality disorder (Tomko et al., 2012) and major
74 depressive episodes (Baddeley, Pennebaker, & Beevers, 2012). Importantly, in all these studies, data
75 of comparable precision, free of the effects of inaccurate self-perception, impression management
76 bias and faulty recall, could not have been collected using more conventional methods.

77 Methods, such as the EAR, that directly sample behavior during daily life raise legal and ethical
78 issues that do not arise in laboratory or questionnaire studies. For example, wearable cameras can
79 produce photographs at regular intervals, and these photographs can then be used as memory cues by
80 participants as they segment their time into situations and describe them (Brown, Blake, and
81 Sherman, in press). This method requires privacy safeguards that closely parallel those practiced in

82 EAR protocols (section 1.1). As another example, smartphone apps have enormous potential to
83 collect data on physical activity, physiological states, locations, and social networks (Miller, 2012).
84 This general method raises legal and ethical issues that have barely been seriously considered.

85 **1.1 The EAR method: details and privacy safeguards**

86 Mehl, Robbins, and Deters (2012) describe EAR methodological practices. For a 2-4 day period,
87 participants wear a recording device (currently, an iPod touch running a dedicated app, iEAR)
88 attached to their clothing, using a protective case with a clip, during all their waking hours to the
89 extent possible. The device makes periodic brief time-stamped audio recordings – in the most typical
90 sampling pattern, a 30-s recording every 12.5 min. Participants know the general sampling pattern.
91 However, the device is locked with a passcode, preventing participants from knowing when
92 recording is occurring, to allow them to conduct their normal daily activities as much as possible.
93 They are also asked to complete an hourly event diary at the end of the monitoring period, noting
94 their major activities and times when they were not wearing the device, as an aid to researchers’
95 interpretations of the audio clips.

96
97 Participants’ privacy is protected by three safeguards. First, the aggregate recording time
98 comprises only 5% of each participant’s day (using the most typical sampling rate), and the brief
99 duration of the clips ensures that they do not capture very much contextualized personal information.
100 Second, at the end of the recording period, participants in all EAR studies are given the opportunity
101 to privately review their audio clips and to delete as many as they wish, before researchers listen to
102 them. Across studies, the percentage of clips deleted is well under 1% (Mehl et al., 2012). Third, no
103 recordings are made during an overnight blackout period (typically, 00:00 to 06:00).

105 **1.2 Legal and methodological issues**

106
107 The EAR method raises both legal and methodological issues. The principal legal issue is the ban, in
108 some jurisdictions, on recording conversations in the absence of the consent of all conversation
109 participants. Applied to the EAR method, these laws require that participants’ interlocutors and other
110 bystanders consent to the recordings. In contrast, photographs taken in public places by wearable
111 cameras are not subject to bystander consent requirements (Brown et al, in press). Eleven to thirteen
112 U.S. states (hereafter, “all-party consent states”; legal opinions differ on exactly how many fall in this
113 category) require the consent of all parties to the recording of conversations (Digital Media Law
114 Project, 2014; Reporters Committee for Freedom of the Press, 2012). Several non-U.S. jurisdictions
115 have similar laws (https://en.wikipedia.org/wiki/Telephone_recording_laws), though it is not always
116 clear whether they apply only to telephone conversations or to face-to-face conversations as well.
117 Interested researchers are advised to consult local legal counsel before conducting an EAR study.

118
119 As described in detail below, our EAR participants displayed to potential interlocutors, a
120 prominent visual text warning (“bystander button”) that their voices may be recorded to comply with
121 California state law. In our view, and under the advice of our legal counsel, such a warning removes
122 the reasonable expectation that the conversation is private. Thus, continuing the in-person exchange
123 serves as passive consent to be recorded. However, this visual text warning also potentially
124 exacerbates three of the EAR’s methodological problems. These problems are (1) participant
125 noncompliance, (2) obtrusiveness or demand characteristics, and (3) self-selection bias. How
126 frequently do participants actually keep the recording device close enough to generate valid
127 recordings? To what extent does awareness of the recording device affect participants’ behavior?
128 Does willingness to wear the bystander button introduce problematic self-selection bias to EAR

129 participant samples? The first two questions have been addressed empirically (Mehl & Holleran,
 130 2007; Robbins et al., 2014), but not using an EAR protocol that attempts to comply with the laws of
 131 an all-party consent state. As described in more detail below, research has shown that participants are
 132 compliant, on average, during 80-90% of their waking time. In debriefing surveys, they report that
 133 their behavior, and the behavior of their interlocutors, was only slightly affected by the presence of
 134 the recording device. Conversations about the recording device have comprised less than 4% of
 135 participants' conversations. However, it is unknown to what degree these findings are applicable in
 136 an all-party consent jurisdiction like California.

137

138 **1.3 The present study**

139

140 The first goal of the present study is to determine whether the prominent visual text warning,
 141 required in all-party consent jurisdictions, decreases EAR participant compliance and/or increases
 142 perceived obtrusiveness. To answer these questions, we compared measures of compliance and
 143 perceived obtrusiveness between a data set provided from a published EAR study in a one-party
 144 consent state (Mehl & Holleran, 2007), and a new EAR data set collected in California, which
 145 requires all-party consent to recording conversations where there is a reasonable expectation of
 146 privacy.

147

148 A third potential methodological problem of the EAR is participant self-selection bias. EAR
 149 participation is arguably more burdensome, both psychologically and logistically, than completing a
 150 self-report questionnaire or performing a laboratory task. Further, the requirement that participants
 151 wear a button visibly on their shirt that indicates conversations may be recorded could add to this
 152 burden. Do samples of EAR research volunteers differ from the broader populations from which they
 153 are drawn? If so, how? The second goal of the present study is to describe self-reported personality
 154 differences between (1) a sample of EAR volunteer participants, who were not drawn from a college
 155 course participant pool but were paid for their participation, and (2) a sample, recruited from the
 156 same student population, of people who did not volunteer for the EAR study but were only
 157 completing a self-report questionnaire as one means of fulfilling a course requirement.

158

159 We measured differences between the EAR sample and the comparison sample in the HEXACO
 160 personality dimensions (Ashton & Lee, 2007). Three of the HEXACO dimensions -- Extraversion,
 161 Conscientiousness, and Openness -- are quite similar to their counterparts in the more widely used
 162 Five Factor Model (FFM: McCrae & John, 1992). Two of the HEXACO dimensions, Agreeableness
 163 and Emotionality, represent an alternative rotation of the personality space covered in the FFM by
 164 Agreeableness and Neuroticism (Ashton & Lee, 2007). Two of the Emotionality facets, Anxiety and
 165 Fear, are also found in FFM Neuroticism, but its other two facets are Sentimentality and Emotional
 166 Dependence, which in some respects resemble facets of FFM Agreeableness. Unlike FFM
 167 Neuroticism, HEXACO Emotionality does not include Anger; instead, Anger is at the low pole of
 168 HEXACO Agreeableness. The HEXACO model's sixth dimension, Honesty-Humility, is its most
 169 distinctive. Comprised of the facets Sincerity, Fairness, Greed Avoidance, and Modesty, Honesty-
 170 Humility is a better predictor than any FFM dimension of a wide variety of exploitative and anti-
 171 social behaviors (Lee & Ashton, 2005; Lee et al., 2013).

172

173 Two considerations suggest that EAR volunteers will differ from their non-volunteering
 174 counterparts with respect to one or more major dimensions of personality. First, successful EAR
 175 participation demands behaviors associated with Conscientiousness, e.g. temporarily taking
 176 responsibility for another party's valuable possession (the iPod) and remembering to recharge the
 177 device nightly. Second, people with prosocial (as distinct from individualistic and competitive) social

178 value orientations are generally more likely to volunteer for psychological experiments (Rosenthal &
 179 Rosnow, 1975; Van Lange, Schippers, & Balliet, 2011). However, because participants in the current
 180 study received a substantial (\$50) compensation, we did not predict that either of the two HEXACO
 181 dimensions related to prosociality (Honesty-Humility and Agreeableness -- Ashton & Lee, 2007)
 182 would be higher in EAR volunteers than in non-volunteers. Comparisons with respect to the traits
 183 other than Conscientiousness should be regarded as exploratory analyses.
 184

185 **2 Materials and methods**

186 **2.1 Participants, procedures and analyses: one-party consent compliant EAR study**

187 M. Mehl (personal communication) provided to the authors the raw data on which the analyses
 188 reported by Mehl and Holleran (2007) were based. Their Sample 1 consisted of 96 undergraduates
 189 (49% female, M age = 18.7, SD = 0.9) who wore the EAR for 48 h on weekdays. They were then
 190 asked to complete the EAR evaluation questionnaire, which consists of eight items, with five-point
 191 Likert-style response scales, tapping the obtrusiveness of EAR participation (Table 1). They were
 192 also asked to estimate the percentage of their waking time during which they were not wearing the
 193 EAR (self-reported compliance). In addition, two behavioral variables were coded from the EAR
 194 recordings. As a measure of obtrusiveness, a percentage of each participant's recorded conversations
 195 that included mention of the EAR study was calculated. As a measure of compliance, the percentage
 196 of audio clips during which the participant was judged not to be wearing the device (i.e. non-
 197 compliant) was calculated, based on auditory characteristics. For more details about this study's
 198 sample and procedures, see Mehl and Holleran (2007) and Mehl et al. (2006).

199 **2.2 Participants and procedures: all-party consent compliant EAR study**

200 This study will be referred to in this paper as "the present study." Ninety-six students at the
 201 University of California, Los Angeles (UCLA), were recruited through class announcements and
 202 posted flyers. They were not drawn from a course participant pool (i.e. their participation was
 203 entirely voluntary). The public title of the study was "Audio Sampling of Daily Life." Participants
 204 were briefed and issued an iPod programmed with the iEAR app. Compensation in the form of a \$50
 205 Amazon gift card was offered for completing the study. At their first appointments, participants were
 206 briefed using scripts slightly modified from those in the iEAR Researcher's Guide (Mehl et al.,
 207 2014), which encourages establishing rapport with participants (e.g. by assuring them that their
 208 privacy will be respected and encouraging them to review their audio clips and delete any clips they
 209 wish). The recording period lasted 72 hours, during which one 30-second recording was made every
 210 12.5 minutes, except between 00:00 and 06:00, when no recordings occurred. Recording periods
 211 could start on any weekday. Participants were also instructed to keep an hour-by-hour event diary at
 212 the end of every day, in which they noted their general activity and whether they were wearing the
 213 iPod during each hour between 6:00am and midnight. The study's theory-driven hypotheses, which
 214 were drawn from Life History Theory, are beyond the scope of this paper (see Manson, in press).
 215

216 Compliance with California's all-party consent law (California Penal Code § 632) was
 217 implemented using a method reviewed by an in-house attorney for the University of California,
 218 Riverside (Robbins, in press). Participants were told about the law and were given a 5.5 cm diameter
 219 button, bearing a microphone icon and the text, "This conversation may be recorded." Materials for
 220 this procedure can be found online at the EAR Repository (Robbins, Wright, Karan, & Baranski,
 221 2016; osf.io/n2ufd). They were instructed to wear this button on the front of their clothing at all times

222 while they were wearing the EAR. It is important to note that this solution must be reviewed by
 223 researchers' own legal counsel before implementing it as a solution to legally implementing an EAR
 224 study in an all-party consent jurisdiction.

225

226 At their second appointments, participants returned the iPod. While the experimenter was
 227 uploading the sound files to a laptop computer, participants were asked to complete the EAR
 228 evaluation questionnaire (section 2.4.1). After the upload was complete, participants were given the
 229 opportunity to review and delete as many audio clips as they wished. They were provided with
 230 headphones, and they were encouraged to refer to their own completed event diaries to help them
 231 focus on time periods that might be of particular concern to them. Finally, participants were given a
 232 link and a password to an online SurveyMonkey™ survey which contained several self-report
 233 instruments, including the HEXACO-60 (Ashton & Lee, 2009). After completing the self-report
 234 instruments, participants were sent the code with which to access their compensation.

235

236

237 **2.3 Participants and procedures: non-EAR comparison sample**

238

239 One hundred sixty-two UCLA students (102 female, 16 of unknown gender as a result of a
 240 programming error, M age = 19.2, SD = 1.6) completed several self-report instruments, including the
 241 HEXACO-60, in fulfillment of a research participation requirement in an introductory
 242 Communication Studies course. The study title provided in the recruitment script was “Personality
 243 and Life Experiences Survey.” Participants were pre-screened to ensure that none of them were
 244 participants in the EAR study. The self-described ethnic composition of non-EAR UCLA
 245 comparisons sample was 31.5% White, 30.9% Asian or Asian-American, 19.1% Latino/a, 3.7%
 246 African or African-American, 1.8% Middle Eastern, and 13% mixed, “other,” or “decline to state.”
 247 Although unrepresentative of college-aged Americans generally, the sample's ethnic composition
 248 was fairly representative of the UCLA undergraduate student body. As of Fall 2014, this was
 249 reported to be 33.5% Asian/Pacific Islander, 12.6% International, 27.1% White, 19.1% Hispanic,
 250 4.0% African-American, 0.5% Native American, and 3.1% of Unknown race/ethnicity
 251 (<http://www.aim.ucla.edu/profiles/main.pdf>).

252

253

254 **2.4 Self-report measures**

255

256 **2.4.1 EAR evaluation questionnaire**

257

258 The EAR evaluation questionnaire (Table 1) was the same as that used by Mehl and Holleran (2007).
 259 Participants were also asked to (1) rate how typical, on a five-point scale (1 = “not at all” to 5 = “a
 260 great deal”), the 72-hour recording period had been with respect to their usual activities, (2) briefly
 261 describe how, if at all, it had been atypical and (3) share any thoughts and feelings they wished about
 262 the experience of wearing the EAR.

263

264 **2.4.2 HEXACO-60**

265

266 The HEXACO-60 (Ashton & Lee, 2009) is a shorter version of the HEXACO Personality
 267 Inventory—Revised (Lee & Ashton, 2004). This instrument contains 10 items tapping each of the six
 268 HEXACO dimensions: Honesty-Humility, Emotionality, Extraversion, Agreeableness,
 269 Conscientiousness, and Openness to Experience. Participants responded on a five-point scale.

270

271 2.5 EAR behavior coding

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306 3 Results

307 3.1 Descriptive results: present study

308

309

310

311

312

313

314

315

316

In addition to the self-report obtrusiveness and compliance items, two behavioral variables were coded from the EAR recordings, following Mehl and Holleran (2007). All intelligible speech by participants was transcribed. As a behavioral measure of obtrusiveness, a percentage of each participant's recorded conversations that included mention of the EAR study was calculated. As a behavioral measure of compliance, the percentage of audio clips during which the participant was judged not to be wearing the device (i.e. non-compliant) was calculated, based on auditory characteristics in combination with the entries in the participant's hour-by-hour event diary. For example, some clips were coded as non-compliant even when the event diary indicated compliance for that time period, based on inconsistency between the two information sources (e.g. an event diary entry of "Dinner in dining hall" in conjunction with clips containing only low-amplitude ambient noise, indicating that the participant left the device in her dorm room while she went to dinner).

2.6 Data analysis

Each participant's clips were coded by one coder. The inter-rater reliabilities of the two behavior codes, along with all the other behavior codes used in the broader research project, were assessed by assigning the 11 research assistants to code a test set of 110 clips containing at least one exemplar of every coded behavior category. Research assistants coded these clips independently, and inter-rater reliability was measured with Cohen's kappa.

Each HEXACO dimension is comprised of four facets (Ashton & Lee, 2007), each of which is tapped by 2-3 items of the HEXACO-60 (Ashton & Lee, 2009). Each facet score was calculated as the mean score across its constituent non-missing items. Each dimension score was then calculated as the mean across its four facet scores.

We used *t*-tests and effect size calculations (Cohen's *d*) to compare results from the present study to Mehl and Holleran's results, and to compare HEXACO dimension scores between our EAR and non-EAR participants. For the data from the present study, we also examined gender differences in perceived obtrusiveness. The ethnic diversity of the present study's sample (section 3.1) limited the statistical power of potential tests of ethnic differences in perceived obtrusiveness. We carried out one such test, comparing Asian and Asian-American participants to other participants. All statistical tests are two-tailed.

Of the 96 EAR participants, 72 (56.9% female, *M* age = 20.3, *SD* = 3.3) completed EAR participation, the EAR evaluation questionnaire, and the HEXACO-60. The self-described ethnic composition of this sample was 53.5% Asian or Asian-American, 16.9% White, 11.2% Latino/a, 2.8% Middle Eastern, and 15.5% mixed or "other."

Eight participants did not complete the study because of their own non-compliance (e.g. neglecting to recharge the EAR), 10 participants did not provide useable EAR recordings because of technical problems (six of which were traced to a problem with the internal microphone of one iPod),

317 and four participants did not provide useable EAR recordings because of experimenter error. One
 318 participant completed the EAR monitoring but did not complete the online self-report questionnaires.
 319 One of the participants who completed both the EAR recordings and the online self-report
 320 questionnaires did not complete the hard copy EAR evaluation questionnaire. The mean (\pm SD)
 321 percentage of audio clips deleted by participants was 1.1% (\pm 2.7%), with a median of zero and a
 322 maximum of 17.6%. Expressed as raw numbers of clips, participants deleted an average of 2.8 (\pm 6.5)
 323 clips, with a maximum of 39.

324
 325 Table 1 shows the mean scores and standard deviations for the EAR evaluation questionnaire
 326 items and the behavioral measures of obtrusiveness and compliance in the present study. The highest
 327 means were for the two items (6 & 7) that reveal participants did not hide the device from others, and
 328 in fact, introduced it, which suggests compliance with our legal and ethical procedures. Also shown
 329 in Table 1 are the means and standard deviations of the two self-report obtrusiveness subscales:
 330 obtrusiveness for participants (mean of items 1-5) and obtrusiveness for bystanders (mean of items 6-
 331 8). The internal reliability of these subscales were $\alpha = .59$ and $\alpha = .61$, respectively. In response to the
 332 open-ended prompt to reflect on the experience of wearing the EAR, only 6 of the 72 participants
 333 (8.3%) mentioned negative reactions to the button warning about the recordings. These accounts
 334 referred to friends and colleagues expressing feelings of disapproval, discomfort, or self-
 335 consciousness, and/or to strangers' suspiciousness, stares, and unwanted questions. Participants were
 336 instructed to pause the device or remove it in instances where conversation partners were
 337 uncomfortable being recorded; however, they did not report how they resolved these encounters.

338
 339 Perceived obtrusiveness did not vary by participant gender. Mean (\pm SD) obtrusiveness for
 340 participants was $1.78 \pm .46$ among women ($n = 41$), and $1.75 \pm .40$ among men ($n = 31$) ($t = -.20$, $d =$
 341 $.07$). Mean (\pm SD) obtrusiveness for bystanders was $2.65 \pm .58$ among women, and $2.75 \pm .84$ among
 342 men ($t = .61$, $d = .14$). Sample size limited our ability to examine potential ethnic differences in
 343 perceived obtrusiveness, but the most powerful possible analysis (Asians and Asian-Americans, $n =$
 344 38 , compared to all others, $n = 34$) revealed no significant differences (obtrusiveness for participants:
 345 Asians and Asian-Americans, $M \pm SD = 1.76 \pm .49$, others, $M \pm SD = 1.77 \pm .37$, $t = .07$, $d = .02$;
 346 obtrusiveness for others, Asians and Asian-Americans, $M \pm SD = 2.70 \pm .68$, others, $M \pm SD = 2.69 \pm$
 347 $.73$, $t = -.09$, $d = .01$).

348 Among 11 coders of the behavioral measures, inter-rater reliability as measured by Cohen's kappa
 349 was substantial for both compliance ($\kappa = .72$) and conversational mention of the EAR study ($\kappa = .82$).
 350 The correlation between behaviorally assessed compliance and self-reported compliance was $.29$ ($p =$
 351 $.014$).

352

353 3.2 Differences between studies in compliance and obtrusiveness

354 Table 1 also shows, for each item, the difference between the scores from the present study and the
 355 scores from Mehl and Holleran's (2007) non-all-party consent compliant study, as well as statistical
 356 comparisons (t -tests and Cohen's d). Participants generally experienced EAR participation as *less*
 357 obtrusive, both to themselves and their interlocutors, in the present study compared to Mehl and
 358 Holleran's (2007) study, even though the present study's participants were required to wear the
 359 bystander button. For example, participants reported that the EAR impeded their daily activities and
 360 changed their behavior significantly less than in the Mehl and Holleran (2007) study. Effect sizes of
 361 these differences were generally small. Participants in the present study talked more about being in

362 the study than did participants in Mehl and Holleran's (2007) study, with a small effect size. Self-
 363 reported compliance was higher in the present study than in Mehl and Holleran's (2007) study, but
 364 behaviorally assessed compliance did not differ between the two studies.

365 3.3 HEXACO dimension scores in the EAR and non-EAR comparison samples

366 Among the 73 EAR volunteers who completed the HEXACO-60 (including the one participant who
 367 completed the EAR protocol but not the EAR evaluation questionnaire), 21/4380 (0.48%) responses
 368 were missing. Among the 162 participants of the non-EAR comparison sample, 39/9720 (0.40%)
 369 responses were missing. Table 2 shows, for each HEXACO dimension, Cronbach's alphas for the
 370 two samples and the results of *t*-tests and the effect sizes of the difference between the samples.
 371 Conscientiousness was higher, and Emotionality was lower, in the EAR volunteers than in the non-
 372 volunteers. The effect sizes of both differences were in the small to moderate range. None of the
 373 other HEXACO dimensions (Extraversion, Agreeableness, and Openness) differed between the
 374 samples, although there was a nonsignificant trend ($p = .06$) for EAR volunteers to score higher than
 375 non-volunteers on Honesty-Humility.
 376

377 As described in sections 2.3 and 3.1, the ethnic composition of the EAR sample differed from that
 378 of the non-EAR comparison sample. Most notably, the EAR sample was 53.5% Asian or Asian-
 379 American, whereas the non-EAR comparison sample was 30.9% Asian or Asian-American.
 380 However, the differences in Conscientiousness and Emotionality between the two samples cannot be
 381 attributed to their differences with respect to proportion of Asians and Asian-Americans. Removing
 382 the data from Asian and Asian-American participants from both samples produced little change in the
 383 group means or effect size for Conscientiousness (EAR: $3.73 \pm .50$; non-EAR: $3.53 \pm .63$; $d = .35$).
 384 For Emotionality, the difference between the EAR and non-EAR samples was increased by removing
 385 from analysis the data from Asian and Asian-American participants (EAR: $3.23 \pm .57$; non-EAR:
 386 $3.51 \pm .63$; $d = .47$).
 387

388 4 Discussion

389 This study examined the obtrusiveness, participant compliance, and self-selection bias of an EAR
 390 protocol adjusted to comply with an all-party consent recording law, compared to the original EAR
 391 protocol. Wearing a button bearing the words "This conversation may be recorded" did not increase
 392 the method's self-reported obtrusiveness to self or others, compared to a published data set collected
 393 from participants who did not wear the button (Mehl & Holleran, 2007). Further, compliance—
 394 participants' reported and behaviorally-assessed wearing the EAR—was highly comparable to the
 395 original protocol. Lastly, we found that self-selection bias for those who volunteer for our EAR study
 396 versus a non-volunteer sample differed mostly in ways common to all volunteer samples. In sum,
 397 these results provide evidence that the EAR method is feasible in an all-party consent jurisdiction
 398 such as California.
 399

400 Self-reported obtrusiveness was significantly lower in the study requiring the bystander button. It
 401 is unclear whether this is attributable to sampling error, cultural changes surrounding the prevalence
 402 of smartphones and their recording functions during the approximately 10 years separating the two
 403 studies, or the difference between sample sources (students fulfilling a course requirement in the
 404 Mehl and Holleran (2007) study vs. students offered monetary compensation in the present study). In
 405 any case, the results indicate that participants in an all-party consent state, at minimum, do not
 406 perceive the EAR method with the bystander button as more obtrusive than it is in a one-party

407 consent state without use of the button. Perceived obtrusiveness did not vary by gender or (to the
408 extent that we could test for differences) self-identified ethnicity.

409
410 Behaviorally assessed obtrusiveness (proportion of conversations in which participants discussed
411 the EAR study) was significantly higher in the present study than in the Mehl & Holleran (2007)
412 study, but was still low (<2% of conversations). This finding is particularly important, as it indicates
413 that the bystander button is effective at increasing awareness that recording is taking place. In
414 conjunction with the finding that the button did not increase perceived obtrusiveness of the method,
415 this indicates that the bystander button serves its main purpose of alerting others to the recording,
416 while doing so with minimal disruption to participants' daily lives.

417
418 Further, rates of behaviorally assessed non-compliance with wearing the EAR device did not
419 differ between the present study and the Mehl and Holleran (2007) study, while self-reported non-
420 compliance was significantly lower in the present study. It is important to note that behavioral non-
421 compliance is the most important measure of this construct, as it reveals how much usable EAR data
422 a study has yielded.

423
424 A limitation of the present study is that participants' interlocutors could not be queried directly
425 regarding their perception of the EAR protocol or how it affected their behavior. Furthermore,
426 potential interlocutors, who did not already know participants, might have avoided interacting with
427 them upon seeing the bystander button. Thus, the all-party consent compliance protocol of this study
428 could have altered participants' social micro-environments in ways that escaped their awareness.
429 Another limitation of the present study is that the participants, and most of their interlocutors, were
430 college-aged. Some research (Hoofnagle, King, Li, & Turow, 2010) indicates that younger adults are
431 less concerned about online privacy than older adults. Perhaps this difference generalizes to concern
432 about the privacy of face-to-face conversations. If so, then older participant samples would be
433 expected to show higher levels of perceived obtrusiveness in an EAR study using the bystander
434 button.

435
436 As predicted, volunteers for an EAR study were more Conscientious than a sample of non-
437 volunteers drawn from the same student population. This is consistent with past work revealing
438 characteristics typical of people who volunteer for psychological studies in general (Rosenthal &
439 Rosnow, 1975; Van Lange, Schippers, & Balliet, 2011). Nevertheless, in any EAR study that
440 includes Conscientiousness, or a trait that is strongly correlated with it, as an independent variable of
441 interest, range restriction could reduce the power of the study to detect hypothesized relationships.
442 Among the other HEXACO dimensions, only Emotionality differed between the EAR volunteer and
443 non-volunteer samples. One of the Emotionality facets is Anxiety, and it is plausible that college
444 students who are more susceptible to Anxiety are more reluctant, even when assured of
445 confidentiality, to expose an audio record of their everyday behavior to examination by a research
446 team. The HEXACO-60 includes only two items that tap the Anxiety facet. Reliability among these
447 items was low ($\alpha = .42$), so the present data set does not permit a test of whether Anxiety,
448 specifically, differed between the EAR volunteer and non-volunteer samples.

449 **5 Conclusion**

450 In conclusion, the EAR method can be successfully implemented in at least one all-party consent
451 state. Researchers wishing to use the EAR method in all-party consent jurisdictions should not be
452 discouraged from doing so by the requirements of complying with legal restrictions; rather, they
453 should work with their own legal and ethical counsel to adopt this or another solution for

454 implementing an EAR study. The specifics of all-party consent laws vary across jurisdictions, and
 455 ethical concerns with this method may vary across IRBs. We encourage researchers to review the
 456 procedure described here with their own legal counsel at their university to ensure proper
 457 compliance.

458 **Ethics statement**

459 The present study was approved by the Institutional Review Board of the University of California,
 460 Los Angeles (Approval #12-001128). Written informed consent was obtained from all participants in
 461 accordance with the terms of that approval.

462
 463 **Author contributions**

464
 465 MLR developed the bystander button protocol and provided extensive comments and edits on the
 466 manuscript. JHM designed the present study, collected the data, analyzed the results, and wrote the
 467 first draft of the manuscript.

468 **Funding**

469 The present study was supported by a Faculty Research Grant from the UCLA Academic Senate to
 470 JHM.

471 **Conflict of Interest Statement**

472 *The authors declare that the research was conducted in the absence of any commercial or financial*
 473 *relationships that could be construed as a potential conflict of interest.*

474 **Acknowledgments**

475 We thank Matthias Mehl for providing data. The research assistants of the UCLA Anthropology
 476 EAR Lab collected and coded the data generated by the present study.

477 **References**

- 478 Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO
 479 model of personality structure. *Pers. Soc. Psychol. Rev.* 11, 150-166.
 480 doi:10.1177/1088868306294907
- 481 Ashton, M. C., & Lee, K. (2009). The HEXACO-60: A short measure of the major dimensions of
 482 personality. *J. Pers. Assess.* 91, 340-345. doi:10.1080/00223890902935878
- 483 Baddeley, J. L., Pennebaker, J. W., & Beevers, C. G. (2012). Everyday social behavior during a
 484 major depressive episode. *Soc. Psychol. Person. Sci.* 4, 445-452. doi:10.1177/1948550612461654
- 485 Brown, N. A., Blake, A. B., & Sherman, R. A. in press. A snapshot of the life as lived: wearable
 486 cameras in social and personality psychological science. *Soc. Psychol. Person. Sci.*
- 487 Conner, T. S., Tennen, H., Fleeson, W., & Barrett, L. F. (2009). Experience sampling methods: a
 488 modern idiographic approach to personality research. *Soc. Personal. Psychol. Compass* 3, 292-
 489 313. doi: 10.1111/j.1751-9004.2009.00170.x
- 490 Csikszentmihalyi, M., Larson, R., Prescott, S. (1977). The ecology of adolescent experience. *J. Youth*
 491 *Adolescence* 6, 281-294. doi: 10.1007/BF02138940
- 492 Digital Media Law Project. (May 14, 2014). Recording phone calls and conversations. Retrieved
 493 from <http://www.dmlp.org/legal-guide/recording-phone-calls-and-conversations>.

- 494 Funder, D. C. (2001). Personality. *Annu. Rev. Psychol.* 52, 197-221.
- 495 Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO Personality Inventory.
496 *Multivar. Behav. Res.* 39, 329-358. doi:10.1207/s15327906mbr3902_8
- 497 Lee, K., & Ashton, M. C. (2005). Psychopathy, Machiavellianism, and Narcissism in the five-factor
498 model and the HEXACO model of personality structure. *Pers. Individ. Differ.* 38, 1571-1582.
499 doi:10.1016/j.paid.2004.09.016
- 500 Lee, K., Ashton, M. C., Wiltshire, J., Bourdage, J. S., Visser, B. A., & Gallucci, A. (2013). Sex,
501 power, and money: prediction from the Dark Triad and Honesty-Humility. *Eur. J. Personality* 27,
502 169-184. doi:10.1002/per.1860
- 503 Manson, J. H. (in press). Are extraversion and openness indicators of a slow life history strategy?
504 *Evol. Hum. Behav.*
- 505 McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *J.*
506 *Pers.* 60, 175-215. doi:10.1111/j.1467-6494.1992.tb00970.x
- 507 Mehl, M. R. (in press). The electronically activated recorder or EAR: A method for the naturalistic
508 observation of daily social behavior. *Curr. Dir. Psychol. Sci.*
- 509 Mehl, M. R., & Conner, T. S. (2012). *Handbook of Research Methods for Studying Daily Life*. New
510 York: Guilford.
- 511 Mehl, M. R., Gosling, S. D., & Pennebaker, J. W. (2006). Personality in its natural habitat:
512 manifestations and implicit folk theories of personality in daily life. *J. Pers. Soc. Psychol.* 90, 862-
513 877. doi:10.1037/0022-3514.90.5.862
- 514 Mehl, M. R., & Holleran, S. E. (2007). An empirical analysis of the obtrusiveness of and participants'
515 compliance with the electronically activated recorder (EAR). *Eur. J. Psychol. Assess.* 23, 248-257.
516 doi:10.1027/1015-5759.23.4.248
- 517 Mehl, M. R., & Pennebaker, J. W. (2003). The sounds of social life: a psychometric analysis of
518 students' daily social environments and natural conversations. *J. Pers. Soc. Psychol.* 84, 857-870.
519 doi:10.1037/0022-3514.84.4.857
- 520 Mehl, M. R., Pennebaker, J. W., Crow, D. M., Dabbs, J., & Price, J. H. (2001). The electronically
521 activated recorder (EAR): a device for sampling naturalistic daily activities and conversations.
522 *Behav. Res. Meth. Ins. C.* 33, 517-523. doi:10.3758/BF03195410
- 523 Mehl, M. R., & Robbins, M. L. (2012). Naturalistic observation sampling: the electronically
524 activated recorder (EAR). In M. R. Mehl & T. S. Conner (Eds.), *Handbook of Research Methods*
525 *for Studying Daily Life* (pp. 176-192). New York: Guilford.
- 526 Mehl, M. R., Robbins, M. L., & Carey, A. L. (2014). *The iEAR (Electronically Activated Recorder*
527 *for the iPod Touch): A Researcher's Guide*.
- 528 Mehl, M. R., Robbins, M. L., & große Deters, F. (2012). Naturalistic observation of health-relevant
529 social processes: The electronically activated recorder (EAR) methodology in psychosomatics.
530 *Psychosomatic Medicine*, 74, 410-417. DOI: 10.1097/PSY.0b013e3182545470
- 531 Mehl, M. R., Vazire, S., Ramírez-Esparza, N., Slatcher, R. B., & Pennebaker, J. W. (2007). Are
532 women really more talkative than men? *Science* 317, 82. doi:10.1126/science.1139940
- 533 Miller, G. (2012). The smartphone psychology manifesto. *Perspect. Psychol. Sci.* 7, 221-237. doi:
534 10.1177/1745691612441215
- 535 Pennebaker, J. W., Francis, M. E., & Booth, R. J. (2001). *Linguistic Inquiry and Word Count*
536 *(LIWC): LIWC 2001*. Mahwah, NJ: Erlbaum.
- 537 Reporters Committee for Freedom of the Press (Summer, 2012). Reporter's Recording Guide: A
538 state-by-state guide to taping phone calls and in-person conversations. Retrieved from
539 <http://www.rcfp.org/rcfp/orders/docs/RECORDING.pdf>
- 540 Robbins, M. L. (in press). Practical suggestions for legal and ethical concerns with social
541 environment sampling methods. *Soc. Psychol. Person. Sci.*

- 542 Robbins, M. L., Focella, E. S., Kasle, S., Weihs, K. L., Lopez, A. M., & Mehl, M. R. (2011).
 543 Naturalistically observed swearing, emotional support and depressive symptoms in women coping
 544 with illness. *Health Psychol.* 30, 789-792. doi:10.1037/a0023431
 545 Robbins, M. L., López, A. M., Weihs, K. L., & Mehl, M. R. (2014). Cancer conversations in context:
 546 naturalistic observation of couples coping with breast cancer. *J. Fam. Psychol.* 28, 380-390.
 547 doi:10.1037/a0036458
 548 Robbins, M. L., Karan, A., Wright, R. C., & Baranski, E. (2016). EAR Repository. Retrieved August
 549 1, 2016, from <https://osf.io/n2ufd/>.
 550 Rosenthal, R., & Rosnow, R. L. (1975). *The volunteer subject*. Oxford: Wiley.
 551 Rozin, P. (2001). Social psychoogy and science: some lessons from Solomon Asch. *Pers. Soc.*
 552 *Psychol. Rev.* 5, 2-14. doi: 10.1207/S15327957PSPR0501_1
 553 Tobin, E. T., Kane, H. S., Saleh, D. J., Naar-King, S., Poowuttikul, P., Secord, E., . . . Slatcher, R. B.
 554 (2015). Naturalistically observed conflict and youth asthma symptoms. *Health Psychol.* 34, 622-
 555 631. doi:10.1037/hea0000138
 556 Tomko, R. L., Brown, W. C., Tragesser, S. L., Wood, P. K., Mehl, M. R., & Trull, T. J. (2012).
 557 Social context of anger in borderline personality disorder and depressive disorders: findings from
 558 a naturalistic observation study. *J. Pers. Disord.* 28, 434-448.
 559 Van Lange, P. A. M., Schippers, M., & Balliet, D. (2011). Who volunteers in psychology
 560 experiments? An empirical review of the prosocial motivation in volunteering. *Pers. Individ. Differ.*
 561 51, 279-284. doi:10.1016/j.paid.2010.05.038
 562 Vazire, S., & Mehl, M. R. (2008). Knowing me, knowing you: the accuracy and unique predictive
 563 validity of self-ratings and other-ratings of daily behavior. *J. Pers. Soc. Psychol.* 95, 1202-1216.
 564 doi:10.1037/a0013314

565

566 Table 1 Legend

567 *N* = 72. Items 1-8 used a scale of 1 = “Not at all” to 5 = “A great deal.”

568

569

570 **Table 1 | Self-reported and behaviorally assessed EAR obtrusiveness and compliance in the all-party consent compliant study (the**
 571 **present study), and comparison with the one-party consent compliant study of Mehl and Holleran (2007).**

Measure	<i>M</i>	<i>SD</i>	Difference from Mehl & Holleran Sample 1	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
Self-reported obtrusiveness for participants: To what degree...						
1. ...were you generally aware of the EAR?	3.0	0.9	0.1	0.34	0.73	+0.06
2. ...did you feel uncomfortable wearing the EAR?	1.8	0.9	-0.2	-1.00	0.32	-0.16
3. ...did the EAR impede you in your daily activities?	1.4	0.5	-0.4	-3.48	0.0006	-0.56
4. ...did the EAR change your actual behavior?	1.4	0.6	-0.2	-2.07	0.04	-0.32
5. ...did the microphone influence your way of talking?	1.3	0.6	-0.3	-2.35	0.02	-0.38
Scale	1.8	0.4	-0.2	-2.30	0.02	-0.30
Self-reported obtrusiveness for bystanders: To what degree...						
6. ...were people around you aware of the EAR?	3.0	1.1	-0.2	-1.34	0.16	-0.22
7. ...did you talk to people around you about the EAR?	3.2	0.9	-0.4	-2.32	0.02	-0.37
8. ...did the EAR influence the behavior of people around you?	1.8	0.8	-0.2	-1.32	0.19	-0.21
Scale	2.7	0.7	-0.3	-2.17	0.03	-0.34
Behaviorally assessed obtrusiveness						
Percent of conversations about the EAR	1.9	3.0	0.6	1.99	0.05	0.30
Self-reported compliance						
Percent of time awake not wearing the EAR	13.9	9.9	-8.6	-3.93	0.0001	-0.64
Behaviorally assessed compliance						
Percent of time not wearing the EAR	8.1	8.6	1.1	-0.58	0.56	-0.09

572

573

574

575

576

577 Table 2 Legend

578 Dimension scores were calculated as the mean across each dimension's four facet scores. Each facet
579 scores were calculated as the mean across its constituent non-missing items.

580 * $p < 0.05$; ** $p < 0.01$

581

Provisional

582 **Table 2 | HEXACO dimension scale reliability and scores of EAR volunteers and non-volunteer comparison sample**

	Honesty-Humility		Emotionality		Extraversion		Agreeableness		Conscientiousness		Openness	
	α	$M (SD)$	α	$M (SD)$	α	$M (SD)$	α	$M (SD)$	α	$M (SD)$	α	$M (SD)$
EAR volunteers	0.75	3.22 (0.65)	0.67	3.29 (0.59)	0.82	3.37 (0.71)	0.84	3.12 (0.75)	0.70	3.70 (0.50)	0.71	3.62 (0.62)
Non-volunteers	0.72	3.06 (0.60)	0.74	3.48 (0.62)	0.81	3.40 (0.67)	0.76	3.14 (0.60)	0.76	3.49 (0.61)	0.74	3.49 (0.60)
<i>t</i>		1.90		-2.21*		-0.38		-0.23		2.67**		1.49
Cohen's <i>d</i>		0.26		-0.31		-0.06		-0.03		0.38		0.21

583