

**A Systematic Comparison of Time Use Instruments:
The Time Diary and the Experience Sampling Method**

Jaeki Jeong, Casey Mulligan, and Barbara Schneider

The earlier Version of this draft is presented *at Time Pressure, Work-Family Interface, and Parent-Child Relationships: Social & Health Implications of Time Use*, an international time-use conference, University of Waterloo, Ontario, Canada and workshop on working family at the University of Chicago.

● Do not cite

For decades, time use studies have provided valuable information on how people spend their time. The accumulation of time use data allows us to examine the impact of recent societal changes on everyday life (Andorka 1987; Robinson and Godbey 1997). With fundamental structural changes, such as the popularization of flexible work hours (Smith, 1997), information technology (Dimaggio et al. 2001), and increases in women's labor force participation (Hayghe 1997.), it is likely that the way people spend time has changed significantly in recent years. The departure from a traditional nine-to-five work schedule and pressures for both men and women to manage work and domestic life simultaneously have undoubtedly increased the heterogeneity of time use patterns across various sociodemographic groups. **Robinson and his colleagues (2002)** have suggested that such changes make it difficult for people to remember precisely how they spend their time. The validity of survey questions used to obtain information on time is thus questionable, and special instruments for examining time use patterns are needed.

This study compares two instruments for time use study: the time diary and the Experience Sampling Method (ESM). While the time diary is widely used in studies of time use and its validity and reliability are well established, the ESM is sometimes regarded as preferable because it obtains information at specific moments across the day and week and thus requires minimal effort in recalling activities in which participants are engaged. Although there is some evidence that time use estimates from both instruments are similar, little is known about differences in the response patterns to these instruments. Based on the responses of individuals who completed both instruments during the same time period, this paper systematically compares the two instruments and evaluates their relative strengths. It then shows how one strength of the ESM—obtaining context-specific information—can improve understandings of time use in the workplace.

In the next section, we compare the two instruments in detail and discuss their strengths and weaknesses. We then examine factors affecting ESM response rates, and factors that affect the probability that ESM and the time diary will report the same activity. This analysis suggests that time diaries provide less biased time use estimates. In the next set of analyses, instances where the two instruments report different activities for the same time period are examined in detail. These analyses suggest that compared to the time diary, the ESM provides a more detailed description of everyday life. This assertion is examined empirically by estimating the number of activity codes used in coding responses to each instrument. We next show how the ESM can be used to provide a more detailed and accurate description of the workplace, where ESM response

rates are relatively high. As Robinson and Godbey (1997) note, the time diary is less successful in obtaining information on specific workplace activities, since diary estimates of time spent in work activities may include non-work activities. We show how the ESM improves on time diary estimates of time spent in workplace activities and provides a better understanding of the conditions middle-class workers face in the workplace.

Two Methods for Studying Time Use: The Full-Day Diary and the ESM

The full-day time diary is perhaps the best known method for obtaining information on time use and has been used in a series of studies at the Universities of Maryland and Michigan, and internationally. Respondents are asked to name the activity or activities engaged in during each of the 96 15-minute intervals occurring during a 24-hour period. These full-day diaries are collected through in-person interviews, telephone interviews, or by response forms sent to the respondent and returned by mail. Some of these studies ask individuals to report what they did on the previous day, while others introduce respondents to the diary and ask them to begin using it when they wake up the next day. Using this method, Robinson and Godbey (1997) have found that time devoted to paid work has not increased since the mid 1960s, despite increasing time pressures faced by individuals; time devoted to leisure, however, has increased, particularly since the introduction of television, which revolutionized how people spend their free time. Other diary studies have examined the amount of time husbands and wives spend on household chores and found that gender inequalities in household labor persist, although the gap is slowly decreasing (Hill 1985; Bianchi et al. 2000).

Created by Csikszentmihalyi and colleagues (Csikszentmihalyi and Csikszentmihalyi 1988; Csikszentmihalyi and Larson 1984), the ESM was primarily designed to examine how individuals spend their time, what they do, and what their subjective interpretations of their emotional states are during specific activities. Used with diverse populations, including adults and adolescents, the ESM has provided estimates on how much time adults spend watching television (Kubey and Csikszentmihalyi 1990), and how much time adolescents spend doing homework, socializing with friends, and being home alone (Csikszentmihalyi, Rathunde, and Whalen 1993; Csikszentmihalyi and Schneider, 2000). ESM participants are given beepers or programmable wristwatches that are randomly activated throughout the day. When beeped, the respondent fills out a self-report form indicating what he or she is doing and how he or she feels at that moment. The individual wears the beeper for approximately a

week, which makes it possible to estimate the amount of time spent on an activity in a single day as well as over the course of a week, taking into account variations in time use that are likely to occur over the weekend.¹

The ESM is assumed to be more reliable than the time diary because it is free from recall bias, a distortion of recollections of past experiences that is sometimes systematic (Bernard et al. 1984). In many ESM studies, more than half of the sample responds to the beep immediately, and about 90 percent of responses are recorded within eighteen minutes of the beep (Hormuth 1986). Due to this minimal recall bias, one could expect the ESM to reflect the timing of activities better than the full-day diary and to provide a more accurate description of these activities.

Although researchers report that time use estimates from full-day diaries are not seriously compromised by recall bias (Robinson 1985; Kalton 1985), **Sudman and Bradburn (1974)** suggest that recall bias depends on the salience of the activity. The more salient the event, the more likely it is to be remembered. Consistent with this conjecture, the full-day diary tends to report fewer “short duration” and “idling” activities—activities that are less salient to respondents—than the ESM (Csikszentmihalyi and Larson 1987). Because information about events must be stored in memory with lexical labels attached (**D’Andrade 1984**), there appears to be some level of abstraction involved in encoding memories. Therefore, full-day diary reports could be expected to provide more general descriptions of activities (e.g., workplace activities) than ESM reports.

The ESM has limitations, however. Because the ESM asks for the activity at a given moment but does not ask for the duration of the activity or prior and subsequent activities, the duration and sequence of activities can be more easily calculated with the time diary method. Other problems with ESM are generally related to non-response. For example, the mean response rate of participants in most ESM studies is less than 85 percent (Hormuth 1986). In other words, participants in ESM studies generally fail to respond to one in five beeps. The nature of the ESM is partly responsible for the relatively low response rate. As Hormuth (1986) notes, since respondents are asked to write responses in a booklet upon hearing the beep, the process might disrupt their daily routine, especially when in public. ESM response rates may also be affected by the activities people are engaged in or by their locations when responding. Therefore, ESM

¹ For a detailed description of the ESM and how it was used in the Sloan Study of Youth and Social Development, see Csikszentmihalyi and Schneider, 2000.

estimates of time use may be biased if no adjustments are made for differential response rates. (Allison 2002)

In sum, previous research suggests that the ESM provides detailed, accurate descriptions of everyday life. However, a major weakness of the ESM is non-response. While the full-day diary is generally regarded as a reliable and valid instrument for time use study, the process of recalling specific events and activities may produce various levels of inaccuracy and abstraction from everyday life.

Hypotheses: Response Rates and Concordance Rates

Attempting to establish the validity of the full-day diary, **Robinson (1975)** compared it with the ESM. He found that the ESM underrepresents activities that occur outside the home, which he thought could be explained by the failure of some respondents to carry their beepers. We re-examine this finding by comparing full-day diary and ESM reports from the same individuals. Hypotheses about the relative strengths and weaknesses of these two instruments, and the extent to which they are likely to be similar in reporting certain types of activities, are summarized below.

Hypothesis 1: ESM response rates will be lower when respondents are in public, but not when they are at work. Hormuth (1986) suggests that ESM response rates are affected not by location itself, but by the nature of the activity. For example, when people swim, they are less likely to respond to the beep. He argues that not all places outside the home will result in lower response rates to the ESM. In line with this supposition, we suspect that being at work does not significantly decrease ESM response rates because participants can easily respond to the beep when engaged in many routine work activities.

Hypothesis 2: The longer the duration of the activity the respondent is engaged in, the lower the ESM response rate. We expect that the duration of an activity will be negatively associated with response rates. For instance, if it is not possible to respond to the beep immediately due the nature of the activity, the longer the duration of the activity after the beep, the more likely the respondent is to miss the beep.

Hypothesis 3: The longer the duration of activities reported in both the full-day diary and the ESM, the higher the concordance rates will be between the two instruments (i.e., the more alike they will be in reporting a given activity). As noted earlier, both the ESM and the full-diary are similar with respect to aggregate estimates. No previous study, however, has examined the concordance rates of individual records from both

instruments. The only available data from previous studies come from comparisons of full-day diary reports from respondents and their spouses. For example, **Juster and Stafford (1985)** compared the diary reports of spouses to determine whether they agreed that the respondent was present during joint activities. In this comparison, about 80 percent of records reporting the respondent's presence were consistent across the spouses' diary reports, which, according to his interpretation, is fairly good. On the other hand, the average concordance rate reported by **Stone and Neale (1979)** was 31 percent.

Since no prior study has reported concordance rates between the ESM and the full-day diary, we focus on overall concordance rates. However, we would expect certain factors, such as the duration of activities, to increase the concordance rates of these two instruments. As mentioned earlier, the salience of an activity should diminish the extent of recall bias. If people are more likely to remember activities of long duration, they are also more likely to remember the exact time at which they were engaged in such activities. Full-day diary reports for these events are therefore less likely to be affected by recall bias and will more closely resemble the ESM reports for these activities.

There is another reason that activities of longer duration might increase concordance rates. Let us assume that the error in remembering the exact time of events varies constantly. For instance, while people cannot always report the exact timing of an activity, they roughly remember when it happens. Further assume that the extent of error in reporting the timing of an event does not exceed twenty minutes and that people remember the duration of that activity perfectly. If the duration of an activity is thirty minutes, then one-third of ESM beeps that occur during activities of this type should be identical to full-day diary reports with respect to maximum error in remembering the timing of the activity. If the duration of that activity is longer than twenty minutes, all ESM reports and diary reports should be similar for that activity.

Hypotheses 4a and 4b: The ESM will require a larger number of activity categories than the full-day diary, and ESM responses will be more specific than full-day diary responses. As noted earlier, the minimal recall bias in the ESM allows people to report the current activity with little or no abstraction. ESM reports thus provide more specific descriptions of everyday life.

Data and Methods

The data for this study come from the 500 Family Study, conducted by the Alfred P. Sloan Center on Parents, Children, and Work at the University of Chicago. The 500 Family Study includes participants from eight cities from across the U.S. and uses multiple instruments, including surveys, in-depth interviews, and child assessments (for a detailed description of the 500 Family Study, see **Hoogstra**, in preparation). Mothers, fathers, and one adolescent in each family wore wristwatches programmed to beep seven or eight times per day over seven consecutive days. A subsample of study participants was chosen to complete a full-day diary for one of their seven days of ESM participation. The full-day diaries were administered either over the phone or in a self-administered format. When the data were gathered by phone, respondents were asked questions about the previous day. When respondents completed the self-administered version of the diary, they were asked to report that day's activities just before they went to bed. Among the 47 diaries that were completed, 3 were discarded because they had fewer than 5 records of activities. Therefore, 44 diaries are used in our analyses; 30 were completed by telephone, and 14 were self-administered mail-in forms.

Our goal in administering the full-day diaries was to compare measures of time use obtained from time diaries and the ESM. It is conceivable, however, that these measures are not independent because respondents might refer to their ESM booklet to construct their full-day diary account of the day's activities. However, in only 1 of the 44 cases were there identical diary and ESM records. Of course, we cannot rule out the possibility that the accuracy of the full-day diaries was enhanced because respondents had previously recorded some of their activities in the ESM booklets.

Ideally, we should have 352 (8×44) records. However, some respondents filled out the ESM booklet when there was no scheduled beep, and two respondents had only seven scheduled beeps per day. The total number of records analyzed is thus 354. Participants responded to 70 percent of the 354 beeps.² In 40 instances (11.2% of beeps), diary records did not indicate specific activities. We were able to identify activities reported in both instruments in 228 instances (62.6% of beeps). Although there is complete information on the gender of respondents, race and level of educational attainment were not available for respondents who did not complete surveys. Respondents who had missing data on the variables of interest were excluded from analyses. Characteristics of the sample are presented in Table 1.

² The average response rate for the full sample is 75.6 percent.

Our analyses focus on three aspects of time use: types of activities reported; the duration of those activities; and the locations at which they occurred. Activities were coded using two different coding schemes. Initial coding of activities for both the full-day diary and the ESM was based on the two-digit coding scheme used by Robinson (1999) to code time diaries.³ Activities were also coded using a more detailed three-digit coding scheme developed for coding activities reported in the ESM, some of which are quite specific (e.g., watching a particular type of television program). Using data from the Canadian Time Survey (Harvey 1999), a time diary study in which activities were coded using the two-digit coding scheme, the mean duration of an activity was obtained by dividing the total minutes devoted to that activity by the number of times the activity occurred. The full-day diary reports of the 44 respondents who completed both time diaries and the ESM were also used to calculate duration of activities. In coding ESM reports, place (i.e., the respondent's location when signaled) was initially coded using specific place codes (e.g., "in the kitchen"; "at the movies"). For purposes of analysis, place was recoded into three categories: in public, at home, and at work. In addition to these variables, we examined the effect of personal characteristics such as gender and educational attainment on ESM response rates and the concordance rates of the two instruments.

In analyses of ESM responses, the dependent variable is whether or not a participant responded to a given beep. In analyses involving ESM and diary reports of the same activity, the dependent variable is the concordance versus nonconcordance of the two instruments (i.e., whether the two instruments report the same activity or a different activity based on the two-digit activity codes used in time diary research). In both cases, the dependent variable is dichotomous; therefore logistic regression is used. Because participants provided multiple responses, standard errors are adjusted using the option available in STATA.

Results

Table 2 reports the results of a logistic regression model examining the effects of selected contextual and personal characteristics on ESM response rates. Results show that location significantly affects the probability of responding to a given ESM signal. The positive signs for "being at work" and "being at home" confirm previous findings

³ The two-digit activity codes were obtained from John Robinson by personal communication. The coding scheme used in our analyses is almost identical with the one used by Robinson (1999).

(Hormuth, 1986). In addition, the higher coefficient for work versus home suggests that lower response rates are not necessarily associated with being away from home. Whether one is in a circumstance to respond to the beep without undue interruption of an ongoing activity seems to be the more crucial factor. As expected, the duration of an activity is also negatively and significantly associated with response rates. Both Hypotheses 1 and 2 are thus supported. There is no significant effect for either gender or educational attainment. These results suggest that the degree to which beeps interrupt everyday activities significantly influences ESM response rates.

Table 2 Results of Robust Logistic Regression on Response Probability of ESM on selected contextual and personal information

Dependent variable: whether ESM response is valid or not	
Duration of activity	-.575 (.205)**
Being at work ^a	1.89 (.625)**
Home place ^a	1.00 (.282)***
Less than 4 year ^b	-.995 (.661)
Female ^c	-.196 (.617)

a: reference category is being at public

b: reference category is college degree and more

c: reference category is male

* p<.05

** p< 01

*** p<.001

^ standard errors are in parenthesis.

Table 3 shows the results of a logistic regression model predicting the probability that the ESM and the full-day diary report the same activity with equal specificity. As expected, duration of activity significantly increases the probability of concordance. One might ask whether this relationship is the result of the longer duration of work activities, since concordance rates might be expected to be particularly high for workplace activities. However, the second column of Table 3 shows that this relationship still holds when workplace activities are omitted. Thus, whether by increasing the salience of an activity in the recall process or by reducing the related error in remembering the timing of the activity, duration increases the likelihood of reporting the same activity in the ESM and the full-day diary.

Table 3 Results of Robust Logistic Regression on Probability of concordance between ESM and FDD on selected contextual and personal information

Dependent variable: whether both instruments reports same activity or not	Overall sample	Non-work place
Duration of activity	1.08	.96 (.31)**
Being at work ^a	(.29)***	-.79 (.42)
Home place ^a	-.12 (.64)	N.S.
Less than 4 year ^b	-.87 (.43)*	.88 (.36)*
Female ^c	.85 (.36)*	-.54 (.33)
	-.40 (.30)	

a: reference category is being at public

b: reference category is college degree and more

c: reference category is male

* p<.05

** p< 01

*** p<.001

One unexpected finding is that the ESM and full-day diary records of more highly educated respondents (those with a four-year college degree or higher) exhibit less concordance than those of less educated respondents. Supplementary analyses were conducted to examine factors that might account for this finding (analyses not shown). Results of these analyses indicate that there are no serious problems with multicollinearity in the model, and that the number of activities reported (used as a measure of the quality of the FDD) does not reduce the magnitude of this negative relationship. Further research is needed to explain this result. Another unexpected finding is that the concordance rate is lower when people are at home, net of duration of activity. One possible explanation for this finding is that respondents may be less sensitive to the timing of activities when they are at home.

Specificity and Accuracy

Thus far we have examined how individual characteristics and contextual factors affect ESM response rates and concordance rates between the ESM and the full-day diary. An examination of non-matching records would provide a better understanding of the strengths and weaknesses of both instruments. Appendix A provides a full description of nonconcordant activities from these two instruments. Distinctive types of nonconcordance were identified for these activities. Figure 1 illustrates the types of

activities identified and the decision rules used in allocating activities to these different categories.

When an activity reported in the ESM appeared in the full-day diary within thirty minutes of the scheduled beep, we classified this difference as an issue of “timing.” About one-fifth of nonconcordant records are classified in this way. Nonconcordance was classified as an issue of “salience” when: (1) an activity of short duration was reported in the ESM; (2) it was possible for the respondent to be engaged in this activity while devoting time to the activity reported in full-day diary; and (3) the activity reported in the ESM was never reported in the diary. There are five cases of this type; activities reported in the ESM but not reported in the time diary include “completing the ESM booklet,” “polishing nails,” and “thinking.”

The third type of nonconcordance, which involves a difference in the “duration” of the activities reported in the ESM and the full-day diary, appears to entail a specific cognitive process. The ESM and full-day diary report related activities, but the activity reported in the ESM seems to be more specific and of shorter duration. This third type of nonconcordance is distinguished from the first type in that the activities reported in the ESM do not appear in the full-day diary; it is also different from second type because the activities seem to be closely related. Most of these cases involve personal care activities. Some examples include “putting on sunscreen” (ESM) versus “getting dressed” (diary); “drying off after showering” versus “showering”; “taking a shower” versus “getting dressed”; and “discussing housework” versus “doing laundry.” The activities reported in the ESM may not be reported in the full-day diary because of their short duration. However, regardless of whether the respondent remembers the activity reported in the ESM, the point is that in the full-day diary they report “getting dressed” as representing related activities such as showering, drying off after the shower, and putting on sunscreen. This example indicates that the full-day diary often provides general descriptions that may effectively describe the activity of the full half-hour time slot, although all the minutes within that slot may not be devoted to that activity. For example, time devoted to housework includes some time spent in discussing and orchestrating housework as well as time devoted to actually doing the cleaning.

The fourth type of nonconcordance, “loss of context,” is very similar to the third type and reveals a weakness of the ESM. Because the respondent sometimes provides too detailed a description of an activity in his or her ESM report, the context of that activity is sometimes lost. For example, a respondent may report “bowling” in the ESM,

but indicate the he or she was attending a birthday party in the corresponding diary entry. Because the full-day diary provides a sequence of activities, such as commuting from one place to another, the purpose of the activity can be known, which is not always easy to determine when looking at ESM entries.

In sum, there are several factors that affect time diary responses. First, people are not always aware of the timing of activities in which they are engaged. Second, remembering past events or activities always entails some degree of abstraction or selective attention to detail. While this process of abstraction sometimes accurately represents the activity, this is not always the case. Therefore, the activity reported in the full-day diary sometimes does not precisely describe the activity in which the respondent was actually engaged.

The results presented in Table 3 are based on a two-digit coding of activities commonly used in coding full-day diary entries. Codes were also assigned to these activities based on a three-digit coding scheme that has been used for coding activities reported for the ESM. This three-digit coding scheme has both general categories (e.g., market work) and more specific categories (e.g., word processing). This more detailed coding scheme makes it possible to quantitatively examine whether full-day diary responses involve a greater degree of “abstraction.” We would expect that compared with the ESM, full-day diaries would more often use general rather specific codes and would thus use fewer codes. As Figure 2 illustrates, the full-day diary does require fewer activity codes than the ESM. The full-day diary uses 71 codes, and the ESM 91 codes, to describe 228 records where activities are reported in both the full-day diary and the ESM.

Additional analysis shows that the number of codes used for the 127 cases in which the ESM and the full-day diary report the same activity using the two-digit coding system is also greater for the ESM than for the full-day diary. A closer look at these cases helps to explain this pattern. While half of the full-day diary records coded as “market work” using the two-digit coding scheme would be coded as “general market work” using the three-digit coding scheme, only one of the corresponding ESM records would be coded in this way. In addition, while most diary records coded as “watching television” based on the two-digit coding scheme would also be coded as “watching television” using the more detailed three-digit coding scheme, about half of the corresponding ESM records provide detailed descriptions of the programs watched. Again, this pattern is highly consistent with our expectation that the ESM provides more accurate descriptions of activities because it is less prone to recall bias.

In addition, a comparison of spouses' reports also suggests that ESM responses are more accurate than full-day diary reports. As noted earlier, **Juster and Stafford** (1985) examined the extent to which the full-day diary reports of spouses are consistent with respect to the presence or absence of the spouse. We conducted the same analysis using data from the 500 Family Study. Table 4 presents concordance rates for spouses from both ESM and full-day diary reports. While the mean concordance rate from the full-day diary is 81 percent, the corresponding rate for the ESM is 91.2 percent.

Table 4 Concordance rate of reporting spouse's presence

		%	%	cf:Time diary
match	both present	19.8		
	neither present	72.3	92.1	80.2
mismatch	just one present	7.9		19.8
				N=9790

ESM Workplace Beeps

One of the contributions of time use studies is that they summarize the quality of life individuals enjoy by estimating the amount of time they spend in various activities. The amount of time people spend in market work is one major indicator of a society's quality of life. Therefore, substantial efforts have been made to estimate time spent in market work. A primary goal of studies of time allocation is to capture "the reality of hours contributed to paid work" (**Harvey and Pentland 1999**, p. 9). Three different sources of national data have been used to address this issue: data from work establishments, workweek estimates, and time diary data (Robinson and Godbey 1997). While all of these approaches have limitations (regarding the limitations of the first two, see Robinson and Bostrom 1994; Robinson and Godbey 1997; and **Robinson et al. 2002**), the time diary is thought to provide the most reliable and valid information on how much time individuals spend in paid work (Juster and Stafford 1985)

There are at least two limitations, however, of time diary estimates of hours devoted to paid work. First, while time diaries can provide very comprehensive information on the daily life of a person, they may not, in practice, provide accurate estimates of time spent over a week or a month. For example, suppose an individual using the single-day diary method reports spending eight hours at work. Can we infer

that person worked 40 hours in the week? Or 56 hours?⁴ Gershuny et al. (1986) suggest that people tend to organize their lives by a weekly schedule. Consequently, a study of one day may in fact give the appearance of excessive substitution of activities across persons, when in fact the substitution occurs for a single person across a specific day or days of the week. Second, the time diary may be subject to some recall bias because diary entries are usually not recorded at the time the activity takes place. Compared with alternative instruments that require minimal recall, such as the Experience Sampling Method or the Random Hour Technique (Robinson 1999), the time diary tends to underreport short duration activities. Time spent at market work may be interrupted frequently, although most workers still report that they work at those times (Robinson and Godbey 1997). For instance, the mean duration of work for pay, 166.2 minutes, is the longest among all activity codes in the Canadian Time Survey (Harvey 1999). This statistic suggests that, on average, workers are engaged in their work for almost three hours without interruption, which is highly unrealistic. Accordingly, it is reasonable to believe that they fail to remember or to report all activities that occur at the workplace.

The work grid developed by the Eurostat Committee tries to overcome these limitations of the time diary by asking respondents: (1) to report time spent at work over a seven-day period; and (2) to isolate lunch breaks and other episodes of non-work during the day (Robinson et al., 2002). By showing that work schedules of less than half of respondents are consistent with the traditional nine-to-five, five-day schedule, Robinson et al. (2002) highlight the difficulty people have estimating their work hours. However, the mean paid work time estimated from the work grid is higher than that from the time diary in a corresponding sample, despite explicitly asking workers not to include non-work related activities in paid work hours. This finding suggests that the invasion of other activities into time at the workplace (e.g., work/home interface) cannot be fully detected by the time diary method. Several researchers thus note that the ESM is an attractive alternative to the full-day diary in the studies of workplace activities (cites).

The ESM data from the 500 Family Study provides information on adult time use, including time on the job. Table 5 briefly summarizes the workplace activities of

⁴ Some full-day diary studies have tried to address this problem by gathering diaries for a few selected days during the year and then constructing a synthetic week. However, a synthetic week is not the same as a calendar week.

adults in the 500 Family Study. Of the more than 30,000 beep responses from 750 participants, respondents answered 7,948 beeps at the workplace; 45.7 percent of these beeps reported a single activity. In 86.8 percent of these instances, respondents were engaged in some type of work activity. When they were engaged in multiple activities, their main activity was work-related 79.3 percent of the time; of the secondary activities reported, 63.5 percent were work-related. Sometimes individuals reported two different activities, both of which were work-related. When only one activity was reported and it was work-related, it was classified as “work with full attention,” a category accounting for 69 percent of total beeps. About 20 percent of beeps reported one work activity together with other non-work related activities, and approximately 12 percent of the beeps reported activities that were not work-related.

table 5. the proportion of work activity

	work	Non-work
Single activity (3634)	86.8	13.2
Main activity (4314)	79.3	20.7
Secondary activity (4314)	63.5	36.5
Work with full attention (7948)	69.0	
Work with other activity(7948)	18.89	
Non-work(7948)	12.11	

Table 6 shows that “walking and transit” accounts for 13.5 percent of these non-work activities. When driving is included, transit activities constitute one-fifth of non-work activities. The proportion of time devoted to “preparing” and “waiting” is also substantial. Meals, including snacks, account for about 15 percent of non-work-related beeps, and talking about non-business matters accounts for about 5 percent of these activities. In sum, about 90 percent of the time, respondents are engaged in some sort of work-related activity at the workplace. However, non-work activities, including those that co-occur with some type of work-related activity, are observed during 30 percent of workplace beeps.

Table 6. the details of non-work activity

Description of activity	%
Walking and transit	13.5
Eating a meal	10.4
Preparing and getting ready to something	10.2
Talking with coworkers (non-work related)	5.9
Driving somewhere	4.4
Waiting to do something	3.2
Looking for something	3.1
Personal care/groom	2.9
Other	

The first column of Table 7 shows how personal characteristics affect the proportion of work performed in the workplace. Females are more likely to be engaged in work activities at the workplace, though the marginally significant interaction term for gender and occupational prestige indicates that gender differences are smaller in higher prestige occupations. Controlling for prestige of occupation, the categorical specification of occupation does not have a significant effect (analyses not shown). Working fewer hours is also related to a higher proportion of work activity. **< I believe this part can be supplemented by new results: (1) mean estimated working hours from the ESM by survey estimates; and (2) the work at workplace is over-estimated while work at home is not.>**

Table 7. The results of weighted least square regression on the proportion of work activity at work place

Dependent variable: proportion of work activity at work place	Unstandardized coefficients
Female	.117(2.45)*
Occupational prestige	.0001(3.02)**
Work hour	.009 (1.70)+
Full time	-.016 (-.934)
Interaction between female and prestige	-.0001 (1.86)+
Constant	.739 (18.65)
Adjusted R square	.021

+ p. <.1

* p<.05

** p< .01

*** p<.001

^ z-values are in parenthesis.

Without comparable data from other time use studies, we cannot directly assert the validity and reliability of these estimates. However, there are two factors supporting the accuracy of these estimates. First, as noted earlier (see also **Jeong, 2003**), the ESM response rate at the workplace is high, which suggests that the bias from non-response is not critically large. Second, using these same data, Rice (in preparation) has found a significant association between type of workplace activity and the respondent's psychological state, which is less likely to be observed if there is strong tendency for respondents to misrepresent the activity for reasons other than recall bias (e.g., social desirability).

Discussion

The results reported above suggest that researchers interested in time allocation should be cautious in choosing the instruments they use to study time use. When researchers are interested in estimating the amount of time spent on various activities, the time diary method would be the safer choice, since ESM studies suffer from non-response, which is non-random (Allison 2002). However, full-day diary reports are sometimes so general that they do not provide accurate descriptions of the activities respondents were engaged in. The ESM can thus be an attractive alternative when research focuses on activities in specific contexts such as home or work. The ESM also allows researchers to examine the psychological states related to specific activities. Rice's (in preparation) work provides an example of the strengths of the ESM. She examines variations in time devoted to core or primary work tasks across occupations and shows that workers feel more engaged and report more positive affect when they are performing primary versus secondary work tasks. In sum, when research focuses on the quantity of time spent in a given activity, the full-day is the better choice. For understanding the specific characteristics of activities, as well as respondents' subjective experiences of those activities, the ESM can provide more useful information.

References

- Andorka, R. 1987. "Time Budgets and Their Uses." *Annual Review of Sociology* 13:149-64.
- Allison, P. D. 2002. *Missing Data*. Sage University Paper Series on Quantitative Applications in the Social Science (7-136). Thousand Oaks, CA: Sage.
- Haythe H.V . 1997. "Developments in women's Labor Force Particiaption" in *Monthly labor Review* 120: 41-46
- Bernard, R., Kilworth, P., Kreonenfeld, D., and Sailer L. 1984. "On the Validity of Retrospective Data: The Problem of Informant Accuracy." *Annual Review of Anthropology* 13: 495-517.
- Bianchi S., Milkie M., Sayer, L., and Robinson, J. 2000. "Is Anyone Doing the Housework?: Trends in the Gender Division of Household Labor" *Social Forces* 79:191-228.
- Csikszentmihalyi, M. and Csikszentmihalyi, I. S. 1988. *Optimal Experience: Studies of Flow in Consciousness*. New York: Cambridge University Press.
- Csikszentmihalyi, M. and Larson, R. 1984. *Being Adolescent: Conflict and Growth in the Teenage Years*. New York: Basic Books.
- Csikszentmihalyi, M. and Larson, R. 1987. "Validity and Reliability of the Experience Sampling Method." *Journal of Nervous and Mental Disease* 175: 526-36.
- Csikszentmihalyi, M., Rathunde, K., and Whalen, S. 1993. *Talented Teenagers: The Roots of Success and Failure*. New York: Cambridge University Press.
- Csikszentmihalyi, M. and Schneider, B. 2000. *Becoming Adult: How Teenagers Prepare for the World of Work*. New York: Basic Books.
- D'Andrade, R. G. 1984. "Cultural Meaning Systems." Pp. 88-122 in R. A. Shweder and R. A. LeVine (Eds.), Culture Theory: Essays on Mind, Self and Emotion. Cambridge: Cambridge University Press.**
- DiMaggio P., Hargittai E., Neuman W., and Robinson, J. 2001. "Social Implications of the Internet." *Annual Review of Sociology* 27:307-36.
- Gershuny, J., Miles, I., Jones, S. Mullings, C., Thomas, G. and Wyatt, S. 1986. "Time Budgets: Preliminary Analyses of a National Survey." *Quarterly Journal of Social Affairs* 2:13-39.
- Harvey, A. "Guidelines for Time Use Data Collection and Analysis" **In** W. E. Pentland, A. S. Harvey, M. P. Lawton, and M. A. McColl (Eds.), *Time Use Research in the Social Science*. New York. Kluwer Academic/Plenum Publishers.

- Harvey, A. and Pentland, W. 1999. "Time Use Research" In W. E. Pentland, A. S. Harvey, M. P. Lawton, and M. A. McColl (Eds.), *Time Use Research in the Social Science*. New York. Kluwer Academic/Plenum Publishers.
- Hill M. S. 1985. "Patterns of Time Use." In T. Juster and F. P. Stafford (Eds.), *Time, Goods, and Well-Being*. Ann Arbor, MI: The University of Michigan Survey Research Center, Institute for Social Research.
- Hoogstra, L. in preparation. "The Design of the 500 Family Study." In B. Schneider and L. Waite (Eds.), *Working Families: Time Apart, Time Together*.
- Hormuth, S. E. 1986. "The Sampling of Experiences in Situ." *Journal of Personality* 54: 262-93.
- Jeong, J. (in preparation). "Obtaining Accurate Measures of Time Use from the ESM" In B. Schneider and L. Waite (Eds.), *Working Families: Time Apart, Time Together*.
- Juster, T. and Stafford, F. P. (Eds). 1985. *Time, Goods, and Well-Being*. Ann Arbor, MI: The University of Michigan Survey Research Center, Institute for Social Research.
- Kalton, G. 1985. "Sample Design Issues in Time Use Studies" In T. Juster, and F. P. Stafford (Eds.), *Time, Goods, and Well-Being*. Michigan: The University of Michigan Survey Research Center, Institute for Social Research.
- Kubey, R. and Csikszentmihalyi, M. 1990. *Television and the Quality of Life: How Viewing Shapes Everyday Experience*. Hillsdale, NJ: Erlbaum.
- Pentland, W. E., Harvey, A.S., Lawton, M. P. and McColl, M. A.(Eds.), 1999. *Time Use Research in the Social Science*. New York. Kluwer Academic/Plenum Publishers.
- Rice, H. (in preparation). "Spending Time at Work and at Home: What Workers Do, How They Feel About It, and How These Emotions Affect Family Life." In B. Schneider and L. Waite (Eds.), *Working Families: Time Apart, Time Together*.
- Robinson, J. 1985. "The Validity and Reliability of Diaries Versus Alternative Time Use Measures." In T. Juster and F. P. Stafford (Eds.), *Time, Goods, and Well-Being*. Ann Arbor, MI: The University of Michigan Survey Research Center, Institute for Social Research.
- Robinson, J. 1999. "The Time-Diary Method: Structure and Uses" In W. E. Pentland, A. S. Harvey, M. P. Lawton, and M. A. McColl (Eds.), *Time Use Research in the Social Science*. New York. Kluwer Academic /Plenum Publishers.

- Robinson, J. P. and Bostrom, A. 1994. "The Overestimated Workweek? What Time Diaries Suggest." *Monthly Labor Review* 117(8): 11-23
- Robinson, J. and Godbey, G. 1997. *Time for Life: The Surprising Ways Americans Use Their Time*. University Park, PA: Pennsylvania State University Press.
- Robinson, J.P., Chenu, A. and Alvarez, A.S. "Measuring the complexity of hours at work: the weekly work grid." *Monthly Labor Review* 125(4): 44-54
- Smith, V. 1997. "New Forms of Work Organization" *Annual Review of Sociology* 23: 315-339.
- Stone,A. and Neale, J.M. 1980 *Development of a Methodology for Assessing Daily Experience*. Arlington ,VA.
- Sudman, S. and Bradburn, N. 1973 "Effects if Time and memory Factors on Response in Surveys" *Journal of American Statistical Association* 68: 805-815