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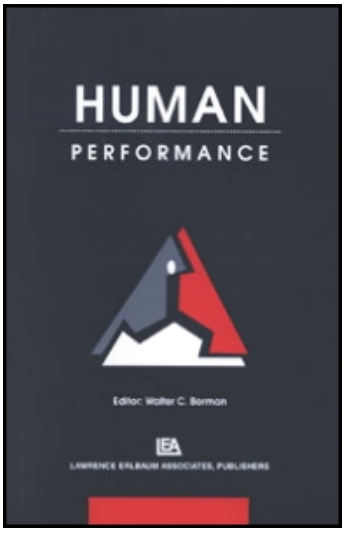

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The Multitasking Preference Inventory: Toward an Improved Measure of Individual Differences in Polychronicity

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This article describes the initial development of a new measure of individual polychronicity, a construct indicating a preference for multitasking as opposed to performing only one task at a time. Following a brief review of past definitional issues, a revised definition is offered and a new measure of polychronicity—the Multitasking Preference Inventory (MPI)—is created based on this definition. Three studies describe the creation, pilot testing, and psychometric refinement of an initial pool of items (Study 1); a convergent and discriminant validity analysis (Study 2); and initial findings with respect to the criterion-related validity of scores on the MPI (Study 3). Together, these findings provide preliminary evidence for the reliability of scores on the MPI and the validity of the MPI in predicting variables relevant to multitasking.

Polychronicity, as it is most generally defined, reflects the preference for multitasking as opposed to performing only a single task at a time (e.g., Slocombe & Bluedorn, 1999). Interest in polychronicity has increased dramatically of late, perhaps most likely as a result of increased interest in and demand for multitasking in the workplace (Lindbeck & Snower, 2000). Due to the implementation of information technology and many other changes in the workplace such as job enrichment, teamwork, and downsizing, the speed and nature of job performance is rapidly changing and traditional notions of job performance are now outdated for many jobs (Ilgen & Pulakos, 1999). Multitasking has now become an important component of job performance for many workers, and some authors have recently asserted that almost every job requires at least some degree of multitasking (Bühner, König, Pick, & Krumm, 2006). As a result organizational researchers have become interested in multitasking and associated predictor constructs such as polychronicity (Delbridge, 2001).

Because polychronicity likely reflects a combination of past experience with multitasking and a stable tendency to perceive multitasking as enjoyable and rewarding rather than stressful, polychronicity should be a particularly useful predictor of multitasking-related constructs.

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Polychronicity has been studied in relation to a wide variety of constructs relevant to multitasking situations including satisfaction, creativity, fit, and performance (e.g., Delbridge, 2000; Hecht & Allen, 2005; König, Bühner, & Mürling, 2005; Madjar & Oldham, 2006). Although many relationships between polychronicity and multitasking-related constructs make logical and theoretical sense, results of empirical studies exploring polychronicity in relation to these constructs have thus far been quite mixed. The definition and measurement of polychronicity has been problematic in this literature, however, which in turn is likely to affect any empirical results and how they are to be interpreted. As is often the case when a construct first begins to receive research attention, the construct of polychronicity is somewhat unclear and multiple definitions and measures of polychronicity are currently in use. At best, this results in difficulty aggregating results such as in a meta-analysis; at worst, it results in a muddled picture of the relationships between polychronicity and related variables, calling relevant theory into question.

In an attempt to remedy some of these issues in conceptualizing, developing, and validating measures of polychronicity, we first review some of these issues and then propose a new definition of polychronicity designed to address them. Next, we present three studies related to the development of a new measure of polychronicity, called the Multitasking Preference Inventory (MPI). Results are discussed with an eye toward the use of the MPI in future research. Finally, based on the work presented here, we propose several future research directions within the topic area.

POLYCHRONICITY: SOME DEFINITIONAL ISSUES

Cultural-Level Definitions

In current organizational research polychronicity is mainly used as an individual difference variable, yet the origins of polychronicity lie in the study of human cultures. E. T. Hall (1959) first defined polychronicity, and as an anthropologist his goal was to describe the extent to which a *culture* values performing multiple tasks at once. His research was qualitative in nature, his descriptions of "polychronic" or "monochronic" cultures were rich and detailed, and his definition of polychronicity was multifaceted. Hall's descriptions of polychronicity not only captured the preference for engaging in multiple tasks at once but also the belief that this cultural preference is generally the "right way" to do things. Hall and his colleagues also included many qualitative descriptions that have very little to do with the performance of tasks (E. T. Hall & Hall, 1990). In an attempt to formalize components of E. T. Hall and Hall's definition, Palmer and Schoorman (1999) proposed that cultural-level polychronicity consists of three components: time use preference, time tangibility, and context. Time use preference was defined as the extent to which people within a culture prefer to do things one at a time or in coordination. Time tangibility was defined as the extent to which time is perceived within a culture as being quantifiable (i.e., is time segmented or does it "flow"). In polychronic cultures, time "flows" and is not kept strictly by observance of the clock or of strict schedules.

The context component of Palmer and Schoorman's (1999) definition of polychronicity was somewhat more complex than the previous two. Communication within polychronic cultures was characterized as being "high context," meaning that information and meaning essential to a message are embedded in the context surrounding the message rather than simply within the message itself. To clarify this dimension, Hall gave the common example of attempting to tell a humorous

story to a friend, eventually relenting by saying, "I guess you just had to be there" (E. T. Hall, as cited by Bluedorn, 1998, p. 112). In contrast with polychronic cultures, monochronic cultures are seen as being "low context," which means that most of the information conveyed by a message is found within the message itself, and the surrounding context is unnecessary.

Another major cultural-level definition of polychronicity that has had perhaps the largest impact on subsequent research has been that of Bluedorn, Kalliath, Strube, and Martin (1999), who defined polychronicity at the cultural level as "the extent to which people in a culture prefer to be engaged in two or more tasks or events simultaneously and believe their preference is the best way to do things" (p. 207). This definition has been especially influential because the most commonly used measure of polychronicity, the Inventory of Polychronic Values (IPV), was based on it. Other definitions have been offered at the cultural level (Onken, 1999; Persing, 1999; Slocombe, 1999; Slocombe & Bluedorn, 1999), but the essence of all of these definitions has been captured in those already discussed.

To summarize, polychronicity was originally defined at the cultural level rather broadly. Definitions were complex, multifaceted, and contained social and cultural aspects appropriate at this level of analysis. Of importance, most definitions included both the preference for multitasking and *the belief that others ought to multitask as well*. As discussed earlier, researchers have recently become interested in applying the cultural construct of polychronicity to more microlevels such as the organization, the group, and the individual, and they have attempted to adopt the cultural definition of polychronicity either wholesale or in part at these levels as well.

Individual-Level Definitions and Measurement

Definitions of polychronicity at the individual level have been highly varied and often quite complex as a result of researchers adopting some aspects of cultural level definitions, leaving others out, and adding new concepts of their own. In addition, definitions of polychronicity at the individual level have differed with respect to whether polychronicity has been conceptualized as the *preference* for performing multiple tasks at once (e.g., Conte, Rizzuto, & Steiner, 1999; König, Bühner, & Mürling, 2005; Persing, 1999) or the actual *behavior* of doing so (e.g., Benabou, 1999; Bluedorn, Kaufman, & Lane, 1992; Cotte & Ratneshwar, 1999; Kaufman, Lane, & Lindquist, 1991).

For reasons of conceptual clarity and empirical modeling, both are both important issues worth attending to. First, the various elements of cultural "context," social norms, or beliefs about whether others should multitask are legitimate things to measure—but they do not measure *individual* beliefs or preferences. Cultural norms may influence individual beliefs, but they do not dictate them. Conversely, a person need not believe that others ought to prefer or believe something to hold such a preference or belief him or herself. Therefore we argue that absent some rationale for the application of the cultural-level definition to the individual level, this and other social or cultural elements should not be included in definitions or measures of polychronicity focused at the individual level.

Second, the distinction between preference and behavior is an important one. A person may prefer to behave in a certain way yet may be forced or may choose to behave in a different way due to pressures or constraints in the environment. For example, an individual may prefer to perform only one task at a time but may be forced to perform multiple tasks at a time by the requirements of his or her job. Likewise, a person may excel at one type of performance (e.g., multitasking perfor-

mance) yet prefer performing tasks a different way (e.g., single-task performance). Of importance, the behavior-based element of past definitions of polychronicity at the individual level has been problematic because the actual behavior of performing multiple tasks at a time is multitasking itself (e.g., Oswald, Hambrick, & Jones, 2007).

Including multitasking behavior in the definition and measure for polychronicity is problematic because often researchers are interested in investigating the relationship between polychronicity and multitasking performance and confounding the measurement of behavior and preference may create spurious relationships or inflate relationships between the two. Thus, we assert that it is essential for a definition of polychronicity, as an individual difference construct independent of multitasking performance, to focus solely on *preference* for multitasking.

Not surprisingly, the measurement of individual polychronicity in the literature thus far has reflected the definitional confusion just discussed. The IPV (Bluedorn et al., 1999) is the most popularly used measure of individual-level polychronicity, but it was initially developed as a measure of cultural-level polychronicity. The authors of the IPV have suggested, and subsequent researchers have adopted, the strategy of simply replacing "we" in the item stems with "I" to translate the scale to the individual level. The IPV is broad based, containing items that address *preference* (e.g., "We like to juggle several activities at the same time"), *behavior* (e.g., "When we work by ourselves, we usually work on one project at a time"; reverse scored), and *belief* ("We believe people should try to do many things at once"). This is not problematic in and of itself, especially when the measure is used at the cultural level. In instances where the measure has been used to assess individual polychronicity, however, we argue that two of these three components are inappropriate for conceptual reasons just discussed. This problem is what drives our need to develop a new scale of polychronicity that focuses solely on the component of polychronicity as a preference for multitasking.

Resolving Definitional Issues

Given the problems we have discussed with respect to the current status of the definition and measurement of polychronicity, we believe it is most appropriate to address these issues by narrowing the definition of polychronicity, then developing a measure with item content that faithfully reflects that definition. According to Dawis (1987), deciding on a definition of the variable of interest is an essential first step in scale construction. Of importance, in addition to the issues just discussed, we believe that another conceptual move forward can be made at this time with respect to polychronicity. A more precise definition of polychronicity is predicated on a clearer conceptualization of multitasking, and the latter has been lacking until recently. Researchers have recently suggested, however, that a key element of multitasking is the relatively quick shifting of attention among tasks, which has both objective components (e.g., number of seconds an employee alternates between talking with a coworker and writing a report) and subjective components (e.g., whether that alternation feels quick or slow to the employee; Oswald et al., 2007).

Thus, the definition that we offer here is that individual polychronicity is a noncognitive variable reflecting *an individual's preference for shifting attention among ongoing tasks, rather than focusing on one task until completion and then switching to another task.* "Task" here is defined as a discrete set of activities engaged in for the purposes of attaining a goal and can be considered and measured from relatively subjective and/or objective points of view (e.g., perceived speed vs. measured speed, complexity, or interdependence of tasks). This definition remedies the problems

just discussed by focusing the definition on individual preference, by avoiding extraneous definitional artifacts from cultural-level definitions, and by keeping polychronicity as a preference conceptually and operationally distinct from multitasking performance. We now describe the development of a new measure of polychronicity, called the MPI, based on the newly proposed definition.

DEVELOPMENT OF THE MPI

In Study 1, we first describe the initial stages of development of the MPI measure along with a pilot study providing evidence for the reliability and unidimensionality of scores on the MPI. In Study 2, we present results from a study investigating the convergent and discriminant validity of scores on the MPI. Finally, in Study 3 we report our efforts from a study providing information regarding face validity, content validity, and criterion-related validity of the MPI in which participants completed the MPI and measures of other multitasking-related constructs and then engaged in a computerized multitasking performance simulation. Study 3 also provides an independent replication of the unidimensionality of the measure.

Study 1: Measure Development and Pilot Testing

Item Generation and Reduction

The first step in the development of the MPI was the generation of potential items by a group of subject matter experts (SMEs). Five SMEs (graduate students and faculty) who were members of a research laboratory focused on the study of multitasking were selected due to their extensive familiarity with multitasking, polychronicity, and related constructs. SMEs were provided with detailed item-generation instructions, including the new definition of polychronicity. The instructions also included general guidelines for writing good survey items (e.g., "Create items that are clear and concise"). SMEs were asked to attempt to create items that reflected the entire potential continuum of polychronicity, from very low to very high. An attempt was made to create a large amount of potential items to sample as representatively as possible from the construct domain (Clark & Watson, 1995). In the end, SMEs created 149 potential items that were then combined and reduced based on criteria of clarity and construct relevance. Throughout the process of item reduction, an awareness of the item content for items that were deleted and items that were kept was maintained by the authors, and it was ensured that the deletion of items was not resulting in a content-deficient measure. At the end of this process, the pilot MPI measure consisted of 26 items.

Pilot Testing

Purpose. Pilot testing served three purposes. The first was to ensure the readability of the measure and to clear up any confusing items or directions, the second was to eliminate items that psychometrically were not functioning properly (e.g., ceiling or floor effects, or little contribution to alpha reliability), and the third was to examine the factor structure of the measure.

Sample. The MPI was pilot tested using a sample of 130 undergraduate students at a large midwestern university who received credit in their psychology courses in exchange for their vol-

untary participation. All participants were between the ages of 18 and 22, 77% were female, and 87% were Caucasian. Because the MPI will primarily be used on college-age participants due to its likely future use in laboratory research on multitasking, this is an appropriate group to use for pilot testing (Dawis, 1987). It is important to note, however, that to establish the psychometric properties of MPI in various groups relevant to future research (e.g., older working-age individuals, military samples) more diverse samples will be required. Due to technical difficulties or nonresponse, data from 19 participants were discarded, resulting in a final sample size of 111.

Procedure. Participants signed up for the experiment through the psychology department's subject pool, and completion of the MPI was entirely online through the use of an online survey system. Respondents were asked to indicate to what extent they agreed or disagreed with each of the 26 statements (items) in the MPI measure. The scale was a 1-to-5 Likert-type scale (*strongly disagree* to *strongly agree*). In addition, participants responded to one *yes*/*no* item asking whether any items in the measure were repetitive and to one *yes*/*no* item asking whether any items were unclear, providing examples if an answer was "yes." Participants were also asked a third open-ended question allowing them to provide comments or input into further development of the measure.

Results. To address the first purpose of pilot testing, an analysis of the qualitative responses participants provided was performed. There was no indication from these responses that participants felt the items were unclear. Although a number of participants indicated that the items were somewhat repetitive, this was an expected result because the measure was in fact designed to tap the narrowly defined construct of preference for multitasking.

To address the second purpose of pilot testing, alpha reliability on the entire scale was first computed and was quite high ($\alpha = .88$). Further statistics indicated that deleting any one of five items would increase alpha. An examination of these items indicated that all of these items either were worded rather extremely (e.g., "While I am driving, I prefer to have the radio off and everyone quiet so I can concentrate solely on driving.") or reflected such common behaviors for college students that not agreeing with an item would be rather extreme (e.g., "I like to talk on my cell phone while driving."). The means of the items in our sample supported this conclusion, being 3.94 for the three high-extreme items and 2.24 for the two low-extreme items (the mean for all other items, excluding these items, was 3.02). Because these items were so extreme, they operated more like a constant than a variable, and thus we decided to delete these items. Alpha was recomputed, and was higher at $\alpha = .90$, acceptable given our previously established goal of .80 for alpha (see Lance, Butts, & Michels, 2006, for an examination of the typically accepted .7 cutoff "myth" for reliability, suggesting that acceptable levels of alpha reliability should be higher).

To address the third purpose of pilot testing, we first conducted a principal axis exploratory factor analysis (EFA) on the 21 remaining items to examine the factor structure of the MPI. This approach is similar to examining alpha reliability when an item is deleted (i.e., low item-total correlations will generally have low factor loadings as well), except that the EFA takes a more integrated approach by examining loadings simultaneously instead of examining separate alpha levels when each item is deleted. The items formed a single factor, as indicated by the scree plot indicating a clear break after the first factor, with one large eigenvalue (7.51) explaining 35.52% of the total variance. Although item loadings for 8 items were below Nunnally's (1978) recommended cutoff of .45, after examining the content of these items we chose to keep 4 of the items because we felt that deleting these items would have resulted in a measure that sacrificed important content.

More specifically, without those items, we felt that the measure would have too few items asking about specific tasks (e.g., using a computer).

In support for retaining these items, the item loadings were very close to the .45 cutoff (.41, .43, .44, and .44). Thus, only four items were deleted. A follow-up EFA was performed excluding these items, and as expected, a stronger one factor solution emerged. Support for this solution was provided by a scree plot showing a clear break after the first factor. Although two additional factors provided eigenvalues slightly over one (1.38 and 1.15), we chose not to retain the three-factor solution for theoretical reasons and because eigenvalues are known to overestimate the number of factors to extract (e.g., Henson & Roberts, 2006). The 17-item version of the measure was retained for use in future analyses.

Discussion. The pilot study relied on a refined definition of polychronicity to take some initial steps in developing and empirically refining the MPI measure of polychronicity, where we further reduced the number of items on the measure on conceptual, practical, and psychometric grounds, while gathering evidence that the measure was sufficiently clear to participants who would be taking the MPI. The refined MPI measure was based on this single sample of pilot data and thus may have capitalized to some extent on sample-specific idiosyncrasies of the data. Appropriate evidence for the reliability and validity of the refined MPI needs to be carried out on independent samples of data, as is described in two subsequent studies that we carried out.

Study 2: Convergent and Discriminant Validity

Purpose and Hypotheses

An essential part of developing any individual-differences measure of a relatively new construct, including the MPI, is establishing that a measure is conceptually and empirically distinct from measures of similar constructs, as well as from previous measures of the same construct. Thus, the purpose of the present study is to explore the convergent and discriminant validity of the MPI by examining its relationships with related measures.

Extraverts, due to their lower baseline level of arousal and higher need for stimulation, tend to prefer situations where they are highly stimulated (König et al., 2005). Conversely, introverts, having a relatively high level of baseline arousal, prefer less stimulation. Therefore, due to the highly stimulating nature of multitasking, extraverts are generally drawn toward and introverts are generally drawn away from it. As a result, polychronicity and Extraversion should theoretically be expected to relate to one another. However, Extraversion is a much broader characteristic than polychronicity, so the two should be empirically distinct from one another.

In addition, although the new definition and measure of polychronicity proposed here are more specific than those used in the past, the MPI and past measures of polychronicity (the Polychronic Attitudes Index [PAI], Kaufman et al., 1991; the IPV, Bluedorn et al., 1999) all measure similar constructs in that they all measure some version of polychronicity. Thus, the MPI should be quite strongly related to past measures of polychronicity because it is meant to tap a portion of the same construct. However, the MPI should be distinct from these measures due to the fact that it is focused on a narrower definition of the construct of polychronicity and on a more focused definition of multitasking. Thus, it should show discriminant validity from these measures and should be more distinguishable from them than they are from each other. We will conduct confirmatory fac-

tor analysis (CFA) to examine the relationships among these variables and the extent to which the MPI measure shows convergent and discriminant validity.

Methods

Sample. Participants were 192 different undergraduates at the same large midwestern university who volunteered for the study in exchange for course credit. Demographic characteristics closely mirrored those of participants in Study 1.

Procedures. Participation in this study was entirely online. Participants first completed the 17-item MPI, refined from Study 1; they then took a 10-item measure from the International Personality Item Pool (IPIP; Goldberg, 1999) to measure Extraversion. Each IPIP item contained a statement such as, "I am the life of the party," and participants rated how well each item described them using a 5-point scale (*strongly disagree* to *strongly agree*). Next, participants completed both past measures of polychronicity, the PAI and the IPV (Bluedorn et al., 1999; Kaufman et al., 1991). Both these measures consist of a number of statements such as, "I like to juggle several activities at the same time," to which participants also used the same 5-point scale.

Results

Internal consistency (alpha) reliabilities, means, standard deviations, and intercorrelations for scores on all measures are shown in Table 1. Alpha for the 17-item MPI was high at $\alpha = .88$. We conducted four CFAs that compared the fit of four nested models to each other. Due to the sample size, items were reduced into parcels. Selection of items for each parcel was done using a method whereby an exploratory factor analysis is first conducted to establish the factor loadings of the items, then the item with the highest factor loading on the first factor is paired with the item with the lowest factor loading, the item with the next highest factor loading is paired with the item with the next lowest factor loading, and so on, until all items have been parceled. This method is intended to create item parcels that are balanced in terms of the influence of the primary factor (R. J. Hall, Singer, & Foust, 1999).

The first model was a one-factor model where all item parcels loaded on a common factor. The second model was a two-factor model where all polychronicity item parcels (for the MPI, PAI, and IPV) loaded on one factor and the IPIPextraversion item parcels loaded on a separate factor. The third model was a three-factor model in which the MPI item parcels loaded on one factor, the PAI

TABLE 1
Study 2 Descriptive Statistics, Reliabilities, and Intercorrelations

	M	*SD*	*1*	*2*	*3*	*4*
1 MPI	43.20	8.63	(.88)			
2 PAI	12.71	2.71	.67*	(.76)		
3 IPV	27.91	5.62	.80*	.77*	(.85)	
4 Extraversion	34.47	6.75	.17*	.20*	.11	(.90)

Note. $N = 192$. Scale alpha reliabilities are listed in parentheses on the diagonal. MPI = Multitasking Preference Inventory; PAI = Polychronic Attitudes Index; IPV = Inventory of Polychronic Values.

*Significant at $p < .05$.

TABLE 2
Chi-Square Test for Convergent and Discriminant Validity Confirmatory Factor Analysis Models

Model	χ^2	*df*	$\Delta\chi^2$	*p*	*CFI*	*SRMR*	*RMSEA*
One-factor model	241.31	35			0.87	0.12	0.18
Two-factor model	102.57	34	138.74	< .001	0.97	0.06	0.10
Three-factor model	61.84	32	40.73	< .001	0.98	0.05	0.07
Four-factor model	57.42	29	4.42	> .05	0.99	0.05	0.07

Note. CFI = comparative fix index; SRMR = standardized root mean squared residual; RMSEA = root mean square error of approximation.

and IPV item parcels loaded on a second factor, and the IPIPextraversion item parcels loaded on a third factor. The fourth model was a four-factor model where MPI item parcels loaded on one factor, IPV item parcels loaded on a second factor, PAI item parcels loaded on a third factor, and IPIPextraversion loaded on a fourth factor. In all models no cross-loadings were incorporated but latent factors were allowed to correlate.

The results presented in Tables 1 and 2 indicate both convergent and discriminant validity results for the MPI. As indicated in Table 2, the one- and two-factor models did not fit the data well, although the two-factor model did fit significantly better than the one-factor model (Hu & Bentler, 1999). The three-factor model, however, fit significantly better than the two-factor model and fit the data well. The four-factor model, by contrast, did not fit significantly better than the three-factor model. These findings indicate both convergent and discriminant validity for the MPI. These findings indicate convergent validity for the MPI because the "MPI" factor was intercorrelated (one-tailed tests) with both the "PAI+IPV" factor and the "IPIPextraversion" factor ($r = .89$, $p < .05$ and $r = .19$, $p < .05$, respectively). It is important to note here that although the correlations between two measures (such as the MPI and past measures of polychronicity) may be high, these measures can still maintain statistically and practically significant differences with criteria. For example, even when two predictors correlate .90, when one of the predictors correlates .30 with a criterion measure the other predictor can still correlate anywhere from –.16 to .59 with the criterion.

The fact that the three-factor model fit significantly better than the one- or two-factor models also indicates discriminant validity because it shows that although the MPI is significantly related to past measures of polychronicity and to a measure of Extraversion, it is empirically distinct from these measures. Moreover, the fact that the four-factor model did not fit significantly better than the three-factor model shows that although previous measures of polychronicity are not empirically separable from one another, the MPI is separable from these measures. This is a particularly important finding given the high correlations among all three of these measures. In combination with the fact that the MPI is *conceptually* distinct from past measures of polychronicity due to the fact that it is based on a narrower definition of the construct, evidence from the CFA provides support for its empirical distinctiveness.

Discussion

Taken together, the results of this convergent/discriminant validity study provide support for the empirical distinctiveness of scores on the MPI. In addition, the results of this study show that

scores on the MPI are related to scores on a measure of Extraversion and on past measures of polychronicity, providing evidence of convergent validity. Although the MPI is highly correlated with the PAI and IPV, it has been argued that the MPI is (a) empirically separate as demonstrated through factor analysis, (b) conceptually distinct, and (c) able to correlate significantly differently with criterion measures. Finally, results of this study provide additional evidence of the internal consistency reliability of scores on the MPI through replication on an independent sample after the MPI measure was refined. In Study 3, presented next, we describe efforts at establishing the criterion-related validity of scores on the MPI as well as replicating the results found thus far. In addition, we provide another test of the unidimensionality of the MPI with a final CFA of the measure.

Study 3: Criterion-Related Validity

Purpose and Hypotheses

To provide support for the theoretical underpinnings and practical uses of a measure of polychronicity, it is important to establish that it predicts relevant multitasking-related outcomes such as enjoyment of multitasking, state-based emotions such as excitement during multitasking, and the intention or decision to multitask in the future. Past research attempting to correlate polychronicity with multitasking performance—or more generally interest measures with job performance measures—have consistently failed to find relationships (e.g., Delbridge, 2000; König et al., 2005). Thus, our hypotheses are as follows:

H1a: The MPI will be positively correlated with enjoyment of the multitasking simulation.
H1b: The MPI will be positively correlated with excitement during the multitasking simulation.
H1c: The MPI will be positively correlated with the number of tasks participants choose to perform at once, given a choice.

Sample

Participants were undergraduates from the same midwestern university, who received course credit in their psychology courses in exchange for their voluntary participation. Again, demographic characteristics closely mirrored those of Studies 1 and 2. The total sample size was 159, though the sample size for analyses performed ranged from 127 to 152 because some participants were missing data from parts of the experiment.

Procedure

Participants signed up for the experiment online, at which time they took the MPI online as what was called a "pretest." Following the MPI measure, participants were administered a 5-item version of a measure of face validity (Smither, Reilly, Millsap, Pearlman, & Stoffey, 1993). The measure included the definition of polychronicity proposed in this article, followed by statements such as, "The actual content of the survey was clearly related to polychronicity." Ratings were made on a 5-point, Likert-type scale (*strongly disagree* to *strongly agree*). In addition, participants

were asked to indicate whether the items were unclear or repetitive, also on a 5-point Likert-type scale. Approximately 1 week later, participants completed the remainder of the experiment in a laboratory setting in groups of five to eight individuals. The experiment occurred in two main sections. During the first section, participants completed the MPI and measures of the other variables involved in the study. During the second section, participants received instructions about a computerized multitasking simulation and then performed the simulation.

Section 1. Measures. As with the aforementioned studies, participants first completed a number of measures online; however, this time the online survey was taken in small groups in a proctored computer lab. As before, participants completed measures of the PAI, the IPV, and the MPI.

Section 2. Multitasking simulation. Following the administration of the measures, participants began the multitasking simulation. The multitasking simulation used was SynWin, a "synthetic" work task that contains four component tasks presented simultaneously (see Figure 1; Elsmore, 1994). The tasks are *memory search, arithmetic, visual monitoring,* and *auditory monitoring*. In the memory search task, a set of letters is presented for a short time and then covered. Subsequently a letter is presented and participants identify whether the letter was a part of the previously shown set. Participants may click the area where the list appeared to reveal the letter set again, but doing so carries a point penalty. In the arithmetic task, participants add two-digit or three-digit numbers. As soon as one addition task is completed, another addition task appears in

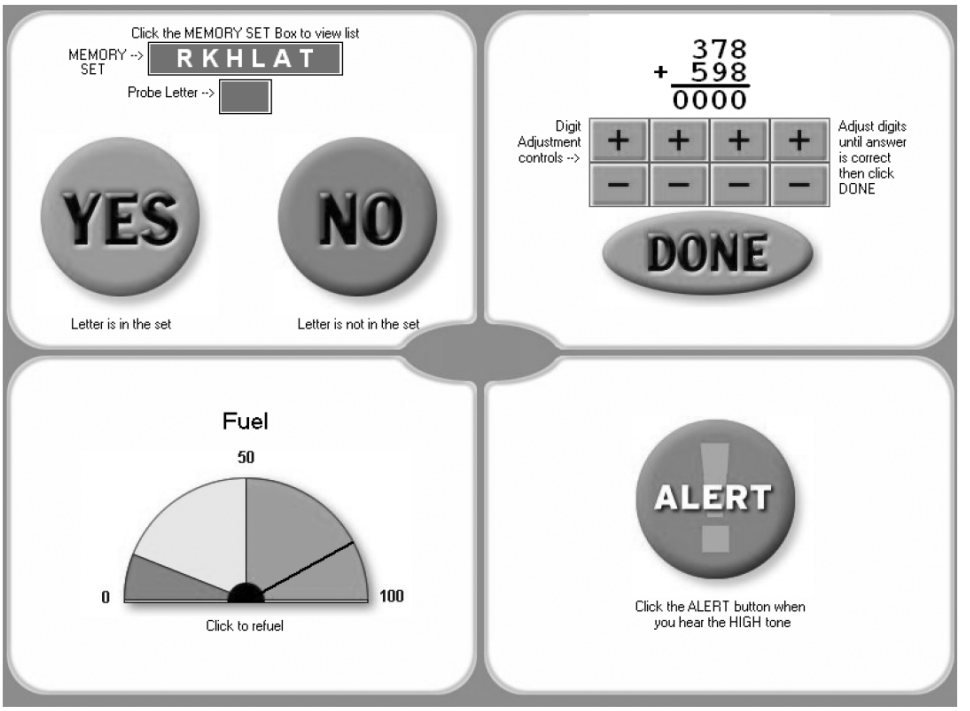

FIGURE 1 SynWin screen shot.

this quadrant. This task is performed at the participant's own pace; there are no time constraints. In the visual monitoring task, a needle moves from right to left across a gauge that resembles a fuel gauge. Participants must click on the gauge to reset the needle before it reaches zero. More points are given for the needle being as close to zero as possible and points are lost proportional to the length of time the needle stays at zero. In the auditory monitoring task, participants must respond to a higher-pitch target tone and ignore a lower-pitch distracter tone. Participants performed the multitasking simulation for two 10-min blocks.

After completing the multitasking simulation, participants were given measures assessing their enjoyment of the multitasking simulation and their level of excitement during the simulation. The measure of excitement consisted of a number of adjectives used to describe emotions, to which the participant indicated how much she or he felt each one during the multitasking simulation on a 5-point Likert-type scale (*not at all* to *extremely*). Example adjectives are *bored* and *excited*. The measure of enjoyment asked participants the extent to which they agreed with a number of statements describing their enjoyment of the multitasking simulation on a 5-point Likert-type scale (*strongly disagree* to *strongly agree*). An example statement is, "I enjoyed the SynWin task."

After completing these measures, participants were asked to imagine that the researchers needed 4 more minutes of performance data from them, but they were free to choose how many tasks of SynWin they would perform at once. Participants were asked to indicate whether they would like to perform one, two, three, or all four tasks at a time. They were then asked an open-ended question regarding why they chose the number of tasks they chose. Participants did not actually have to perform these tasks and were then thanked for their participation and excused.

Results

Reliability. Internal consistency (alpha) reliabilities, means, standard deviations, and intercorrelations for all measures are reported in Table 3. As can be seen, internal consistency reliability and convergent/discriminant validity evidence remained similar to that found in the previous studies. To establish that items were still functioning as expected, item-remainder correlations

TABLE 3
Study 3 Descriptive Statistics, Reliabilities, and Intercorrelations

	N	*M*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1 MPI Pretest (17)	127	52.74	9.08	(.88)							
2 MPI Pretest (14)	130	41.95	8.21	.98*	(.89)						
3 MPI (17)	147	53.37	9.51	.85*	.83*	(.90)					
4 MPI (14)	149	42.54	8.56	.82*	.83*	.98*	(.91)				
5 PAI	152	13.29	2.66	.62*	.62*	.73*	.74*	(.80)			
6 IPV	151	29.42	6.12	.75*	.76*	.85*	.84*	.79*	(.89)		
7 Excitement	150	30.70	6.54	.00	–.05	.08	.04	–.03	.00	(.82)	
8 Enjoyment	150	13.20	3.26	.17	.13	.31*	.28*	.31*	.30*	.42*	(.83)
9 Choice	152	3.20	.91	.02	.01	.18*	.17*	.29*	.22*	.12	.57*

Note. Scale alpha reliabilities are listed in parentheses on the diagonal. Numbers in parentheses for Multitasking Preference Inventory (MPI) measures represent the number of items in the measure. PAI = Polychronic Attitudes Index; IPV = Inventory of Polychronic Values.

*Significant at $p < .05$.

TABLE 4
Item Content for 14-Item Multitasking Preference Inventory

1. I prefer to work on several projects in a day, rather than completing one project and then switching to another. (.77)
2. I would like to work in a job where I was constantly shifting from one task to another, like a receptionist or an air traffic controller. (.39)
3. I lose interest in what I am doing if I have to focus on the same task for long periods of time, without thinking about or doing something else. (.41)
4. When doing a number of assignments, I like to switch back and forth between them rather than do one at a time. (.73)
5. I like to finish one task completely before focusing on anything else. (R) (.77)
6. It makes me uncomfortable when I am not able to finish one task completely before focusing on another task. (R) (.60)
7. I am much more engaged in what I am doing if I am able to switch between several different tasks. (.64)
8. I do not like having to shift my attention between multiple tasks. (R) (.68)
9. I would rather switch back and forth between several projects than concentrate my efforts on just one. (.81)
10. I would prefer to work in an environment where I can finish one task before starting the next. (R) (.58)
11. I don't like when I have to stop in the middle of a task to work on something else. (R) (.62)
12. When I have a task to complete, I like to break it up by switching to other tasks intermittently. (.74)
13. I have a "one-track" mind. (R) (.52)
14. I prefer not to be interrupted when working on a task. (R) (.41)

Note. Items followed by (R) are reverse-scored. Numbers in parentheses following each item represent corrected item-total correlations.

were also examined. Three items had quite low item-remainder correlations (under .35). Upon examination, we discovered that all three of these items were also included in the set of items that had previously been problematic in terms of low factor loadings but that had been retained due to concerns over content representativeness (i.e., all were task-specific items). After once again examining the overall content of the items in the measure, we decided to remove these items due to the fact that similar content was reflected in other more general items and we did not feel that their removal would adversely affect content validity. Alpha for the 14-item measure (see Table 4 for a complete listing of items and item-total correlations) was slightly higher at $\alpha = .91$. Test–retest reliability, as estimated by the correlation between scores on the 14-item MPI at Time 1 (online sign-up) and scores on the 14-item MPI at Time 2 (lab session, approximately 1 week later) was $r = .83$.

Unidimensionality. A CFA was performed to test whether the one-factor solution retained in the pilot study would replicate on an independent sample. Due to the sample size, items were also parceled in this sample in the same way as in the previous study. The fit indices resulting from the CFA indicated that the model fit the data very well, and thus unidimensionality was supported ($\chi^2 = 33.05$, $p < .05$, goodness of fit index = 0.95, standardized root mean squared residual = 0.04, root mean square error of approximation = 0.07).

Face and content validity. The mean face validity rating across items was 3.5, meaning that overall participants agreed that the MPI reflected the construct of polychronicity as defined here. Content validity was also assessed by having five SMEs rate the extent to which the 14-item MPI reflected the construct of polychronicity in its entirety. As an index of interrater agreement, we computed ICC(1), which indicates the amount of variance in ratings that is shared among raters (McGraw & Wong, 1996). The ICC(1) for content validity ratings was .85. Because ICC values are comparable to reliability coefficients, an ICC(1) of .7 or greater was set as the cutoff. Thus,

there was substantial enough agreement to merit combining the ratings (LeBreton, Burgess, Kaiser, Atchley, & James, 2003). The mean content validity rating was 4.53, which indicated that the SMEs agreed that the scale reflected the construct of polychronicity.

Criterion-related validity. To test H1a, enjoyment of the multitasking simulation was included as the criterion in a simple linear regression with MPI as the predictor. In support of H1a, the MPI was a significant predictor of enjoyment, standardized $\beta = .28$, $F(1, 147) = 12.24$, $p < .05$, $R^2 = .08$. To test H1b, a simple linear regression was performed with excitement during the multitasking simulation as the criterion and the MPI as the predictor. The analysis failed to provide evidence that the MPI was a significant predictor, standardized $\beta = .04$, $F(1, 146) = .24$, $p = .64$, $R^2 = .00$ and thus H1b was not supported. To test H1c, the number of tasks participants choose to perform during the "extra" 4-min performance session was included as the criterion in a simple linear regression with the MPI as the predictor. In support of the hypothesis, the MPI was a significant predictor of the number of tasks chosen, standardized $\beta = .17$, $F(1, 148) = 4.40$, $p < .05$, $R^2 = .03$. With respect to the effect sizes (R^2 values) associated with both of the significant effects, though the effect sizes may be considered small to medium by typical conventions (Cohen, 1988), we felt that they were sufficiently high to provide support for our hypotheses due to the multiply determined nature of both enjoyment and task choice. Further, due to the fact that these effects were obtained in the laboratory it is possible (though not certain) that they would be larger in the field due to differing environments and motivation levels. Although it was not hypothesized, we also tested whether the MPI was a significant predictor of performance at multitasking and found that it was not, $\beta = .07$, $F(1, 150) = .66$, $p = .42$, $R^2 = .00$.

Discussion

Study 3 provided additional evidence of the internal consistency reliability of scores on the MPI in a third independent sample, which also allowed for an additional refinement of the measure. We also confirmed the unidimensionality of the measure in an independent sample. The study also provided evidence in support of test–retest reliability, face validity, content validity, and criterion-related validity of scores on the MPI. In addition, the findings that the MPI predicted enjoyment of a multitasking simulation and the number of tasks participants would choose to perform if given the chance are each important and interesting contributions to the literature on multitasking and polychronicity.

GENERAL DISCUSSION

The present article has reviewed definitional issues with respect to polychronicity, proposed a new definition of polychronicity, and described the construction of a measure of polychronicity (the MPI) based the new definition. In three studies, it has been shown that scores on the MPI exhibit acceptable levels of reliability and validity. With respect to reliability, scores on the MPI were found to exhibit high test–retest and internal consistency reliability. Although extremely high levels of internal consistency may sometimes be of concern if they reflect a measure that is too narrow, high levels of reliability (e.g., $\alpha = .91$) are appropriate in this case because the MPI was designed to tap a focused construct. In addition, the high test–retest reliability provides some evidence that the MPI measures a stable characteristic over time. With respect to validity, scores

on the MPI were tested in relation to a number of sources of evidence for validity. The content validity of scores on the MPI was rated by experts and found to be satisfactory. The high ratings received by the MPI with respect to content validity reflect the fact that the items within the measure each tap the construct of polychronicity (and nothing else), and that as a set, the items reflect the entire content domain of polychronicity. In addition, face validity ratings were found to be acceptable.

With respect to convergent and discriminant validity, scores on the MPI showed promising evidence of prediction unique from scores on measures of related constructs. Scores on the MPI were related to, yet distinct from, scores on a measure of Extraversion and past measures of polychronicity. With respect to criterion-related validity, though scores on the MPI did not predict excitement during the multitasking simulation, they did significantly predict both enjoyment of the simulation and the number of tasks participants would have chosen to perform in an additional performance block.

A side note here is that after they chose how many tasks they would like to perform if the experimenters had asked them to perform one more SynWin block, participants were asked why they chose the amount of tasks they chose. A purely exploratory investigation into these responses provides some interesting information. For participants who indicated that they would like to perform four tasks (the maximum number of tasks, $n = 69$), the most frequently reported answers were that doing so would be *challenging* ($n = 12$), that they were simply *comfortable* ($n = 11$) doing four tasks at once, or that any fewer would be *boring* ($n = 10$). The qualitative responses given by participants may help explain why no significant relationship was found between polychronicity and excitement. Words like *challenging*, *comfortable*, and (lack of) *boredom* do not convey a great deal of excitement. It seems plausible, therefore, that individuals high in polychronicity may not have been particularly "excited" by the multitasking simulation but rather were simply fulfilled in terms of the amount of multitasking or stimulation they desired.

In addition, these data suggest that perhaps highly polychronic people might derive more personal fulfillment out of jobs requiring higher levels of multitasking, would be more satisfied with them, and would be left unsatisfied with or bored by jobs that do not allow them to multitask. This finding has potential practical significance with respect to the MPI and to polychronicity in general because it speaks to the potential usefulness of polychronicity. In the military setting, the MPI may be useful as a placement tool for jobs requiring high levels of multitasking, such as air traffic controller. In the organizational, school, or counseling setting, the MPI might prove useful as a career counseling tool to aid individuals in deciding for what type of work they are best suited. An individual high in polychronicity, because she or he may be more likely to enjoy multitasking than an individual low in polychronicity, might find these jobs more rewarding on the whole. Although it is purely speculative, one might infer that these individuals would also be less likely to burn out or turn over from these jobs due to their general enjoyment of them.

Regarding how to make multitasking-based job classification operational, the O*NET database (see http://online.onetcenter.org) contains variables that characterize occupations on a whole host of worker and work characteristics, including characteristics related to multitasking such as information ordering (following rules in a prescribed order), speed of closure (speed in making sense out of a lot of information), flexibility of closure (detecting patterns in the midst of distractions), time sharing (shifting between two or more sources of information), and reaction time (speed of responding to signals). Composite scores, based on these O*NET variables, could be used to rank jobs in terms of their multitasking requirements, and individuals could be

classified into those jobs based on their multitasking interests and/or their multitasking performance.

Of course the findings in this study with respect to such satisfaction-related outcomes are only preliminary; however, the knowledge that such relationships are possible should prove useful in future research, which is discussed later. Taken together, the measure evaluation findings indicate that the MPI shows clear evidence of reliability, some evidence of various types of validity, and promise as a predictor of multitasking-related outcomes.

Limitations and Future Directions

The present study possessed some potential limitations that could be addressed by future research. First, the sample used in the present study was restricted to college undergraduates, a sample whose generalizability to the college population is obvious but whose generalization to the adult workforce at large is questionable in some respects. For instance, one aspect of our sample that might be in question is whether they were motivated to perform well at the multitasking simulation as compared with a sample of adults for whom multitasking performance would be a part of their work performance. Our data, however, do not show floor effects in multitasking performance, and thus it is clear that participants were at least somewhat motivated to perform the task. Moreover, though perhaps there was reduced variance in performance due to a lack of motivation, the outcome would be attenuation of the correlations between multitasking performance and other variables in the study. Thus, our study is conservative in its estimates of the ability of the MPI to predict performance and future researchers should attempt to replicate this work in more diverse samples.

A second limitation of the present sample is the age of the participants. Research has shown that multitasking ability decreases with age (e.g., Salthouse, Hambrick, Lukas, & Dell, 1996), and as such the results of multitasking studies performed with participants of college age may not generalize well to age-diverse populations. In fact, polychronicity scores may also fall with age because as multitasking becomes more difficult with age, interest in multitasking may decline. The relationship between polychronicity and age has thus far gone unresearched and would be an interesting substantive inquiry for future research. Although the present sample was reasonable for this study, given the need to conduct initial steps in measure development and validation, future studies should attempt to replicate the reliability and validity findings of this study using more diverse samples, particularly in terms of age, motivation, and work experience.

A final limitation of this study is its use of self-report measures for all variables. Relationships in the study measures may have been inflated due to common method variance. Participants filled out all the measures in the same format (an online survey) with very similar response scales for all measures. In the future, researchers might also consider supplementing perceptual measures with a number of different behavioral outcomes. For example, to measure task choice, one might provide participants with a number of choices of tasks to perform while he or she waits for the experimental session to start. By varying the task choices and collecting data on which participants choose which activities, researchers could assess actual choice behavior rather than intentions in a hypothetical situation. Another possibility for a behavioral measure is to collect data on career choices with respect to their level of multitasking and determining whether factors like polychronicity predict the choice of a career track high in multitasking (e.g., air traffic controller). Further, future researchers should measure a broader range

of multitasking-related variables in an attempt to explore the nomological network surrounding polychronicity and the MPI.

In addition to future directions suggested by limitations in the present study, a final direction for future research is suggested by the results of this study. Instead of focusing on performance at multitasking, polychronicity researchers might find stronger relationships by focusing on satisfaction- or fulfillment-related outcomes. These outcomes are important because workers who are more satisfied or fulfilled by their jobs, or who experience greater levels of fit with their job and the organization as a whole, may be more motivated and less likely to burn out or leave the organization (e.g., Mathieu, 1991). An important consideration here is that ability or intelligence may play a role in the type or degree of multitasking an individual finds rewarding or challenging as well, suggesting that interaction effects between multitasking preference and skill might be profitably investigated. More generally, future research should integrate polychronicity into broad models of person-job and person-organization fit.

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