Stress Outcomes of Four Types of Perceived Interruptions

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Objective: We sought to define and measure four types of perceived interruptions and to examine their relationships with stress outcomes.

Background: Interruptions have been defined and measured in a variety of inconsistent ways. No study has simultaneously examined the subjective experience of all types of interruptions.

Method: First, we provide a synthesized definition and model of interruptions that aligns interruptions along two qualities: origin and degree of multitasking. Second, we create and validate a self-report measure of these four types of perceived interruptions within two samples (working undergraduate students and working engineers). Last, we correlate this measure with self-reported psychological and physical stress outcomes.

Results: Our results support the four-factor model of interruptions. Results further support the link between each of the four types of interruptions (intrusions, breaks, distractions, and a specific type of ruminations, discrepancies) and stress outcomes. Specifically, results suggest that distractions explain a unique portion of variance in stress outcomes above and beyond the shared variance explained by intrusions, breaks, and discrepancies.

Conclusion: The synthesized four-factor model of interruptions is an adequate representation of the overall construct of interruptions. Further, perceived interruptions can be measured and are significantly related to stress outcomes.

Application: Measuring interruptions by observation can be intrusive and resource intensive. Additionally, some types of interruptions may be internal and therefore unobservable. Our survey measure offers a practical alternative method for practitioners and researchers interested in the outcomes of interruptions, especially stress outcomes.

Keywords: distractions and interruptions, attentional processes, job stress, psychometrics, mental workload

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Interruptions in the workplace have been conceptualized in many ways (Jett & George, 2003) and linked to numerous outcomes, both positive and negative. Outcomes range from improved vigilance (Helton & Russell, 2015, 2017) and decreased state stress (Finkbeiner, Russell, & Helton, 2016) to increased mental workload, psychological distress, frustration, perceptions of time pressure, and perceptions of necessary effort (Mark, Gudith, & Klocke, 2008). These seemingly contradictory findings may be due to differences in the many ways interruptions have been defined and measured. Some (e.g., Helton & Russell, 2015, 2017) focused on rest and breaks, while others (e.g., Mark et al., 2008) focused on unexpected intrusions from others or workplace distractions. Speier, Valacich, and Vessey (1999), for example, distinguished distractions from interruptions, given their differential relationships with outcomes. Jett and George (2003) proposed that all interruptions, including distractions, are stimuli that inhibit progress on the primary task. This definition identifies intrusions, distractions, breaks, and discrepancies as four types of interruptions. They argued that any type of interruption may have a constellation of positive or negative outcomes. The goals of this paper are to further conceptualize four types of interruptions upon two key dimensions in the literature (i.e., internality versus externality, concurrent versus sequential multitasking), to provide a method of measuring the subjective experience of interruptions, and to establish relationships between the subjective experience of interruptions in the workplace and stress outcomes.

Given the ubiquitous nature of interruptions, they have been defined and measured in many ways. For example, Mark, Gonzalez, and Harris (2005) categorized interruptions in an external or internal dichotomy in which external interruptions "are those that stem from the events in the environment, such as a phone ringing" (p. 322)

and internal interruptions are "those in which one stops a task of their own volition" (Mark et al., 2005, p. 322). Li, Magrabi, and Coiera (2012), however, defined an interruption as "a secondary activity that requires one's attention and stops interaction with the primary task" (p. 6). Jett and George (2003) provided another definition of interruptions, suggesting they are "incidents or occurrences that impede or delay organizational members as they attempt to make progress on work tasks" (p. 494). Others failed to define interruptions altogether (e.g., Czerwinski, Horvitz, & Wilhite, 2004; Gillie & Broadbent, 1989), placing the burden of definition on the reader or the study design. This may result in the readers assuming the interruptions being studied were limited to those that originated externally (e.g., a coworker knocking on one's door), while the authors actually included more nuanced forms of interruptions like distractions. As such, it is necessary to have a unified definition and conceptualization of interruptions that allows for specification of the type and nature of interruptions.

We offer a definition designed to combine two existing conceptualizations, specifically, Mark and colleagues' (2005) aforementioned internal and external dichotomy and the unified theory of multitasking continuum (Salvucci & Taatgen, 2010). In the following sections, we expand upon this definition with a four-factor model of interruptions to capture their multidimensional nature. Additionally, we identify where Jett and George's (2003) interruption taxonomy items fall within the two dimensions.

Beyond the lack of a unified definition of interruptions, the subjective perception of interruptions has been almost entirely ignored. To the authors' knowledge, only two studies (Erlandsson, Björkelund, Lissner, & Håkansson, 2010; Sevdalis, Forrest, Undre, Darzi, & Vincent, 2008) have measured the subjective experience of interruptions. Erlandsson and colleagues (2010) relied on a single item, "I'm often interrupted and disturbed when I'm doing something" (p. 227), which cannot adequately capture the multidimensionality of interruptions. Sevdalis and colleagues (2008) provided an extensive measure, but it does not easily generalize beyond the context of surgery.

Studies that measure interruptions objectively do so through direct manipulation of task progression in lab studies (e.g., Foroughi, Werner, Nelson, & Boehm-Davis, 2014) or by observing the frequency and/or duration of interruptions in the field (e.g., Levin et al., 2006). In a review of studies targeting interruptions in health care, Rivera-Rodriguez and Karsh (2010) identified 33 relevant articles, but only one used a survey to capture individuals' perceptions (e.g., Sevdalis et al., 2008). The remaining articles relied primarily on direct or indirect methods of observation (e.g., video/audio recording or interruption logging).

Objective measurement methods have several limitations. Observations and, to an extent, experimental manipulations are limited to interruptions that are observable. Objective methods are limited in practicality for applied settings, like health care, in which manipulation of interruptions is rarely effective and observation of interruption frequency and duration is prohibitively costly. Further, objective methods may not be appropriate when studying outcomes of interruptions such as stress.

These methods fail to account for a key mediating variable in stress processes, the cognitive appraisal of the stressor (e.g., Lazarus & Folkman, 1987), which suggests that a stimulus may be perceived as a stressor by some but not by others. This difference in perception, according to many stress theories (e.g., Frese & Zapf, 1994; Lazarus & Folkman, 1987), is a more proximal predictor of stress outcomes than the objective stimulus itself. Therefore, this paper aims to contribute to both science and practice by providing a unified definition and model of interruptions, creating a measure of perceived interruptions, and establishing the relationship between perceived interruptions and stress outcomes.

FOUR-FACTOR MODEL OF INTERRUPTIONS

To understand the role interruptions play in predicting stress outcomes, we clarify what an interruption is. The literature has isolated two key aspects of interruptions that can be used to better define their nature: the degree of multitasking and the origin of the interruption. Together, these two dimensions create a four-factor model of interruptions.

The first dimension is the degree to which an interruption results in concurrent or sequential

		Source of Interruption	
		External	**Internal**
Degree of Multitasking	**Sequential**	**Intrusion** *Examples include:* - *Co-workers asking for something* - *Email that demands attention* - *Supervisor calling an immediate meeting*	**Break** *Examples include:* - *Taking a lunch break* - *Checking social media* - *Sitting, doing nothing*
	Concurrent	**Distraction** *Examples include:* - *Coworkers talking in the hall* - *Background music playing* - *Flickering lights*	**Rumination** *Examples include:* - *Mind wandering* - *Focusing on worries from earlier or later* - *Task is much harder than expected*

Figure 1. A comparison of the types of interruptions (Jett & George, 2003).

multitasking. Concurrent multitasking occurs when individuals engage in frequent cognitive switches from one task to another, resulting in essentially simultaneous task engagement. Sequential multitasking is marked by clear disengagement with one task prior to engagement with another. The unified theory of multitasking continuum (Salvucci & Taatgen, 2010) suggests that task switching varies along a continuum of concurrent to sequential multitasking. Several existing interruption definitions align with this dimension. Li and colleagues (2012) suggested that an interruption completely halts interaction with the primary task, in line with sequential multitasking. Eyrolle and Cellier (2000) defined an interruptive task as one that occurs during the execution of a larger primary task. They described a second type of interruption, time-sharing tasks, as those that co-occur and must be executed essentially simultaneously, in line with concurrent multitasking. Jett and George (2003) proposed that interruptions slow progress on the primary task, suggesting that interruptions may not necessitate that an individual engage in sequential multitasking.

The second dimension is the origin of the interruption. Mark and colleagues (2005) proposed this dichotomy, dividing interruptions into those with internal or external origins. Jett and George (2003) also alluded to the origin of certain interruptions, suggesting that it is a key characteristic.

We define interruptions as events or stimuli with either an internal or an external impetus that may result in concurrent or sequential multitasking with a primary task. Taken together, these two dimensions create four mutually exclusive and exhaustive domains of interruptions. Given that the domains of interruptions each represent a unique combination of the key characteristics of an interruption, each domain is likely to have a unique relationship with stress and well-being outcomes. By overlaying the taxonomy of interruptions put forth by Jett and George (2003) upon our four-factor model (see Figure 1), we provide clearer boundaries for the constructs they first defined and expand their theoretical focus from discrepancies to ruminations. This allows these four unique types of interruptions to be better measured and thus used more appropriately as predictors of stress outcomes. These four types of interruptions are intrusions, distractions, breaks, and ruminations.

Intrusions. Intrusions are defined by Jett and George (2003) as unexpected events, initiated by another person, that completely and temporarily halt task progress. Based on the dimensions of our four-factor model of

interruptions, intrusions are those that have an external source and result in sequential multitasking. This expands upon the definition provided by Jett and George (2003) by incorporating external sources beyond other people.

Intrusions may be the prototypical interruption; they are generally what is manipulated or observed in studies (e.g., Czerwinski et al., 2004; Gillie & Broadbent, 1989). Often, intrusions are not necessarily captured exclusively and may be combined with other observable interruptions. For an example of an intrusion, take the case of a manager working in her office, filling out reports. The light in her office flickers and burns out, so she stops what she is doing and replaces it. The light became an intrusion the moment the manager stopped her work to replace it. Given that intrusions are unexpected due to their external origin and result in sequential multitasking, thus placing a long-term burden on the individual, we hypothesize that self-reported intrusions (1a) will be positively correlated with psychological stress and (1b) negatively correlated with well-being.

Breaks. Breaks are defined by Jett and George (2003) as events that result in sequential multitasking but are planned or self-initiated. When defined using our four-factor model, breaks must result in sequential multitasking and must have an internal stimulus. Although breaks are often seen as beneficial (Jett & George, 2003) by allowing individuals to redirect their cognitions to less cognitively taxing tasks (Elsbach, 2001) or nothing in particular (Henning, Jacques, Kissel, Sullivan, & Alteras-Webb, 1997; Jett & George, 2003), there are many studies that link breaks to stress outcomes such as fatigue (e.g., Fritz, Lam, & Spreitzer, 2011). This line of research necessitates further explorations into the potential negative effects of breaks. Jett and George (2003) suggested that the delays in task progression and the time demand associated with returning to a task after a break may have unexplored negative consequences. Returning to the example of the manager, if when the light burns out, she chooses to use the restroom, this has become a break. Certainly the light was an external stimulus, but the manager, instead of continuing to work or engaging with the external stimulus, chose to address an internal need. This choice originated internally, and since she did not choose to engage with the external stimulus, the impetus of the disengagement with the primary task was the internal need. Upon returning to work she must exert effort to find where she left off. Given that breaks do result in sequential multitasking, and may therefore actually increase time pressure, we hypothesize that (2a) self-reported breaks will be positively correlated with psychological stress. We also hypothesize that (2b) breaks will be negatively correlated with well-being.

Distractions. Distractions were defined by Jett and George (2003) as cognitive reactions to external stimuli. By redirecting cognitive resources away from the primary task and toward the distraction, distractions decrease productivity in the main task (Jett & George, 2003). This is in line with the multiple resources theory of mental workload, which suggests that if two stimuli pull from different resources, based on modality and demand, they can be processed simultaneously rather than sequentially (e.g., Wickens, 2008). In our four-factor model, distractions have external stimuli but, unlike breaks and intrusions, result in concurrent multitasking. Further, distractions do not necessarily result in observable behavioral changes, with the majority of their influence remaining in the cognitive domain. Distractions have also been the object of a wealth of scientific studies (e.g., Strayer & Drews, 2004; Zhang, Smith, & Witt, 2006), and like interruptions as a whole, distractions have been the subject of many definitions (e.g., Coraggio, 1990), some of which include interruptions as a type of distraction. Speier and colleagues (1999) differentiated between interruptions and distractions, suggesting that an interruption is an extreme case of a distraction. Instead, we suggest that a distraction is a unique case of an interruption, resulting in multiple, attentional micro-disengagements with the primary task while allowing the individual to remain engaged overall, albeit at a lower level, with the primary task. Returning to our example of the manager and the light, before the light burns out, when it is flickering, the manager's attention is partially divided between the forms she is completing and the flickering light. She

does not entirely disengage from the forms, but the entirety of her attention is not directed toward them either; therefore, the external stimulus of the light that results in concurrent multitasking with the primary task is a distraction. Given that distractions are unpredictable, we hypothesize that they will (3a) be positively correlated with psychological stress and (3b) be negatively correlated with well-being.

Ruminations. According to Jett and George (2003) discrepancies occur when expectations about the task or environment are violated (Jett & George, 2003). Within our four-factor model, we find that this definition fills only a portion of the final quadrant, given their unique limitation to task-related cognitive violations. We suggest, instead, that discrepancies are a type of rumination. Ruminations are the larger domain of interruptions that have internal stimuli and result in concurrent multitasking. Given that much research has been done focusing on ruminations, they have been well defined, and given that we are interested in psychological stress outcomes, which are difficult to disentangle from ruminations as a whole, we instead focus on discrepancies as a unique subset of ruminations that needs further exploration. When discrepancies occur, attention is partially shifted away from the task and toward the discrepancy, thereby hindering progress toward completion of the primary task (Jett & George, 2003). Discrepancies cannot result in sequential multitasking with the primary task; otherwise they become breaks. We suggest that the most common discrepancies will occur when individuals unexpectedly lose or gain resources. Returning to our manager, if when the lightbulb burns out, she chooses to continue working, she is facing a discrepancy. She was expecting to have access to adequate lighting while completing her reports, but now her attention is divided between the task and the discrepancy between her expectations of the task and the actual manner in which she had to carry out the task (in the dark as opposed to in adequate lighting). Given that discrepancies should slow cognitive processing and thus increase time pressure, we hypothesize that discrepancies will be (4a) positively correlated with psychological stress and (4b) negatively correlated with well-being.

INTERRUPTIONS AND STRESS

Interruptions have been linked to stress outcomes. For example, Lin, Kain, and Fritz (2013) found that objective interruptions were linked to physical symptoms, emotional exhaustion, and anxiety. Yet the primary method of measuring interruptions in research is observation rather than self-report. Although intrusions, breaks, and to an extent, distractions can be observed and measured in an environment, discrepancies are, by definition, internal and nonobservable. In part, this may account for the lack of interruptions-based research on discrepancies. Additionally, observation is resource intensive, requiring hours of monitoring the workplace, and may often be impractical. Yet this method of measurement remains the primary, if not only, option for interested parties to capture interruptions, thus limiting the scope of research. There does not yet exist a sole measure that captures perceptions of the frequency of intrusions, breaks, distractions, and discrepancies, making it difficult to compare the differential impact of each interruption type. We seek to examine their combined ability to explain variance in psychological stress and well-being outcomes.

METHOD

This research complied with the American Psychological Association code of ethics and was approved by the institutional review board at the University of South Florida (Pro00022801 and Pro00031351). The institutional review board provided a waiver of need to obtain consent given the minimal risks. To examine the relationship between the perceptions of four domains of interruptions and psychological stress and well-being outcomes, we first had to develop a measure of these perceptions.

Item Generation

The authors generated 51 items to capture the four domains of interruptions. To be included, items had to explicitly capture both dimensions (internality/externality and degree of multitasking) of the type of interruption. Items were designed to reflect the literature, particularly the four types of interruptions highlighted by Jett and George (2003). Items were generated

by the three authors individually and then compared for redundancy and theoretical deficiency within each domain proposed by Jett and George (2003). Items that did not meet the above criteria were not included. Thus, the number of items per dimension ranged from 10 to 16. To measure intrusions, distractions, breaks, and discrepancies, 13, 12, 10, and 16 items were evaluated, respectively.

Item content validation. Four subject matter experts (SMEs) were presented with the definitions of intrusions, breaks, distractions, and discrepancies. SMEs were three doctoral candidates and one master's-level graduate student in industrial-organizational psychology. Each SME had experience in scale development and a research program focusing on workplace stressors. SMEs were asked to sort each item into one of the four domains. Items were considered to clearly address the content domain if at least three of the four SMEs sorted the item appropriately. A total of 50 items matched this criterion, with only 7 being sorted incorrectly by one SME, and 1 being sorted incorrectly by three SMEs. This latter item was flagged for exclusion from the final measure.

Participants and procedure. Sample 1: Participants for the initial measure examination were recruited through an undergraduate psychology pool and were given the measures of the four types of interruptions and then measures of psychological stress and well-being. To be eligible, participants had to currently be working 20 or more hours. Of the 282 participants who completed the online questionnaire, 59 were deleted due to not meeting the 20-hour work minimum, and 32 were deleted due to missing data. The final sample size was 192. The sample was 59.9% Caucasian, 18.8% Hispanic/Latino, 15.6% Black/African American, 4.2% Asian, and 1.5% Other. The sample was 71.4% female, had a mean age of 22.93 (*SD* = 5.85), and worked an average of 28.79 weekly hours (*SD* = 7.52).

Sample 2: Participants for the measure validation and confirmation of relationships found in the student-working sample were recruited through an online listserv of professional engineers in the United States. To be eligible, participants had to currently be working 20 or more hours. Of the 296 participants who completed the online questionnaire, 67 were removed for missing data, failure to meet the minimum working requirement, or failed attention checks, resulting in a final sample of 229 participants. The sample was 76.4% Caucasian, 8.7% Hispanic or Latino, 5.2% Asian, 0.9% Black or African American, and 8.8% Other. The sample was 76.9% male, had a mean age of 45.77 (*SD* = 13.05), had a mean tenure of 9.85 years (*SD* = 9.46), and reported working an average of 44.68 (*SD* = 7.81) hours per week.

Measures: Physical stress outcomes were measured with 27 items from Derogatis and Melisaratos's (1983) brief symptom inventory. Participants were asked to indicate how frequently (1 = *never*, 7 = *always*) they experienced each symptom in the past 30 days. Example symptoms include poor appetite and trouble concentrating. Psychological stress outcomes were measured with the Job-Related Affective Well-Being Scale (Van Katwyk, Fox, Spector, & Kelloway, 2000). Participants were asked to indicate the amount that (1 = *never*, 5 = *extremely often/always*) any part of their job has made them feel a given emotion in the past 30 days. Interruptions were measured using the 51 generated items. Participants were asked to indicate how often in the past week (1 = *never*, 6 = *very frequently*) they experienced a variety of situations.

RESULTS

Measure Purification

The measure purification process had two goals: (a) create four separate subscales representing the four types of interruptions and (b) retain a limited number of items so that each subscale had only five items to minimize cognitive burden on participants, thus enhancing ease of use for researchers and practitioners. From the initial pool of 51 items administered to Sample 1, we used exploratory factor analysis, confirmatory factor analysis (CFA), and item analysis to select five items for each of the four scales. We did not allow item errors to correlate in any models. First, we ran an exploratory factor analysis with oblimin rotation and maximum likelihood estimation to ensure our items aligned

TABLE 1: Initial Exploratory Factor Analysis Results

Item	Intr.	Dist.	Break	Disc.	Neg.	Item	Intr.	Dist.	Break	Disc.	Neg.
1	.37	.39				**27**			**.65**		
2	**.69**					28			.36		
3	**.65**					**29**	**.49**		**.50**		
4	**.65**					30			.42		.45
5					.44	31			.39		.59
6			-.37		.33	**32**			**.58**		
7	**.78**					**33**			**.55**		
8	**.63**					**34**			**.51**		
9	.37					35			.62		
10	.48					36				.41	.57
11			.62			**37**				**.56**	
12						38					.59
13			.49			39					.51
14		.36				**40**				**.57**	
15				.32		41				.66	
16		**.64**				42			.33		
17					.40	43					
18		**.64**				44				.71	
19		.33			.61	45					
20		**.38**				**46**				**.71**	
21		.62				**47**				**.61**	
22			.52			48				.44	
23			.45			49				.56	
24		**.57**				**50**				**.53**	
25		**.58**				51				.45	
26											

Note. Items kept for finalized measures are in boldface. Factor loadings less than .30 are suppressed. Intr. = intrusions factor, Dist. = distractions factor, Disc. = discrepancies factor, Neg. = negatively worded item factor. $\chi^2(1030) = 1475.67$, $p < .001$, comparative fit index = .87, Tucker Lewis index = .84, root mean square residual = .05, root mean square error of approximation = .05.

with the theoretical structure and to identify any items that cross-loaded. Examination of the scree plot, parallel analysis, and the number of eigenvalues greater than 1.00 indicate a five-factor solution, which upon examination contained one factor for each theoretical construct and a fifth factor that captured negatively worded items (see Table 1). Any items that did not highly load (loading greater than .30; e.g., Costello & Osborne, 2005) on their respective factor were not included in the final measure. Next, we ran CFA individually for each subscale. We present item loading and item-total correlation results for each of the four scales in Table 2. We retained items (a) demonstrating high factor loadings, (b) demonstrating high item-total correlations (.60 and greater; e.g., Hair, Black, Babin, & Anderson, 2010), and (c) not exhibiting redundancy with other high-loading and high-item-total correlation items.

After we finalized the scales' items (see the appendix), we proceeded to test whether the theoretical model of four individual types of interruptions was the best representation of the data. For

TABLE 2: Item Pool Factor Loadings and Corrected Item-Total Correlations

	Intrusion		Distraction		Break		Discrepancy	
Item	Loading	Corrected Item-Total	Loading	Corrected Item-Total	Loading	Corrected Item-Total	Loading	Corrected Item-Total
1	.703	.607	.777	.576	.210	.221	.452	.461
2	**.802**	**.712**	.547	.363	**.689**	**.628**	**.653**	**.601**
3	**.757**	**.683**	**.958**	**.810**	.597	.423	.205	.214
4	**.661**	**.614**	.267	.212	**.763**	**.576**	.130	.097
5	.114	.133	**.785**	**.733**	.221	.349	**.674**	**.609**
6	.224	.219	.316	.260	.110	.216	.687	.642
7	**.763**	**.673**	**.791**	**.642**	**.747**	**.615**	.250	.235
8	**.731**	**.653**	.958	.813	**.638**	**.578**	.377	.370
9	.508	.464	.700	.500	**.769**	**.621**	.647	.579
10	.528	.456	.749	.536	.520	.490	.372	.375
11	.398	.348	**.824**	**.666**			**.639**	**.611**
12	.437	.456	**.897**	**.755**			**.717**	**.717**
13	.428	.416					.691	.625
14							.469	.467
15							**.790**	**.695**
16								

Note. Items kept for finalized measures are in boldface. Total items created for each scale ranged from 10 to 16 for a total of 51 items generated.

TABLE 3: Model Fit Statistics

Factor	χ^2	*df*	*p*	CFI	TLI	RMSEA	RMSEA CI	SRMR
1 Factor	680.73	170	<.001	.534	.479	.151	(.140, .163)	.132
2 Factor Internality	591.63	169	<.001	.614	.566	.138	(.126, .150)	.121
2 Factor Multitasking	645.42	169	<.001	.565	.511	.147	(.135, .159)	.141
4 Factor	326.95	164	<.001	.851	.828	.087	(.073, .101)	.091

Note. TLI and CFI values greater than .900 and RMSEA values less than .050 suggest adequate model fit. CFI = comparative fit index; TLI = Tucker Lewis index; RMSEA = root mean square error of approximation; RMSEA CI = root mean square error of approximation confidence interval; SRMR = standardized root mean square residual.

this, we used the data from Sample 2. CFAs tested four competing, theoretically meaningful models: a single factor model where all 20 items loaded onto one factor, a two-factor model where items measuring intrusions and distractions (external interruptions) loaded onto one factor and breaks and discrepancies (internal interruptions) loaded onto the other factor, a two-factor model where items measuring intrusions and breaks (sequential multitasking) loaded onto one factor and distractions and discrepancies (concurrent multitasking) loaded onto the other factor, and a four-factor model where intrusion, distraction, break, and discrepancy items loaded onto four individual factors. Table 3 presents fit statistics for the four models. As shown in Table 3, the four-factor solution has better fit statistics values than the single or two-factor solutions, suggesting that the proposed model containing four distinct interruption subtypes is the most appropriate conceptualization. The item loadings for the finalized scales are presented in Table 4.

TABLE 4: Finalized Scale Item Loadings

Item	Intrusions	Distractions	Breaks	Discrepancies
1	.861	.853	.622	.788
2	.874	.685	.775	.677
3	.595	.621	.332	.620
4	.501	.658	.838	.577
5	.644	.671	.712	.652

TABLE 5: Scale Means, Standard Deviations, and Intercorrelations

	M1	SD1	M2	SD2	1	2	3	4	5	6	7	8	9	10
1. Overall interruptions	62.11	16.39	75.98	13.42	*.90* *.94*	.81*	.78*	.62*	.79*	–.41*	–.21*	.52*	.45*	.56*
2. Intrusions	16.01	5.20	20.00	4.87	.88*	*.86* *.87*	.52*	.22*	.63*	–.32*	–.17*	.39*	.31*	.45*
3. Distractions	15.11	4.76	16.97	4.70	.86*	.68*	*.83* *.85*	.37*	.43*	–.36*	–.20*	.44*	.42*	.48*
4. Breaks	15.23	4.90	18.78	4.10	.78*	.54*	.58*	*.79* *.86*	.33*	–.22*	–.05	.33*	.31*	.28*
5. Discrepancies	15.97	4.55	20.23	4.18	.81*	.66*	.59*	.47*	*.83* *.84*	–.34*	–.20*	.40*	.33*	.46*
6. JAWS overall	61.98	10.81	3.48	0.48	–.34*	–.28*	–.38*	–.24*	–.26*	*.93* *.91*	.88*	–.88*	–.55*	–.72*
7. JAWS positive	30.81	7.22	3.26	0.54	–.13	–.12	–.17*	–.10	–.08	.91*	*.91* *.92*	–.56*	–.33*	–.53*
8. JAWS negative	21.09	6.33	2.30	0.55	.54*	.42*	.53*	.36*	.48*	–.76*	–.45*	*.90* *.88*	.64*	.73*
9. Somatic symptoms	13.58	7.27	2.20	0.64	.41*	.31*	.39*	.32*	.29*	–.42*	–.18*	.63*	*.84* *.92*	.70*
10. Anxiety	8.43	4.07	2.82	0.86	.44*	.36*	.40*	.28*	.36*	–.52*	–.29*	.69*	.76*	*.89* *.80*

Note. Sample 1 data are below the diagonal, and Sample 2 data are above the diagonal. Scale reliabilities (Cronbach's alpha) are presented in italics along the diagonal, Sample 1 reliabilities are presented below Sample 2 reliabilities. Pairwise deletion was used, thus N = 148–192 for Sample 1 and N = 222–229 for Sample 2. Correlations were computed between calculated scale means. M1 = mean for Sample 1; SD1 = standard deviation for Sample 1; M2 = mean for Sample 2; SD2 = standard deviation for sample 2; JAWS = Job-Related Affective Well-Being Scale.
*$p < .05$.

Hypothesis Testing Results

Scale means, standard deviations, intercorrelations, and reliabilities are presented in Table 5. Correlations referenced in hypothesis testing are those in Table 5.

Hypothesis 1a suggested that perceived intrusions would be positively related to psychological stress outcomes. Results suggest that in both samples, intrusions are significantly and positively correlated with anxiety ($p < .001$), somatic symptoms ($p < .001$), and negative affect well-being ($p < .001$), thus supporting Hypothesis 1a. Hypothesis 1b suggested that intrusions would be negatively related to well-being; this was not supported in Sample 1 ($p = .13$) but did receive

TABLE 6: Multiple Regression Results

	Anxiety			Somatic Symptoms			JAWS Negative			JAWS Positive		
Scale	β	R^2	*p*	β	R^2	*p*	β	R^2	*p*	β	R^2	*p*
Sample 1		**.20**	**<.001**		**.19**	**<.001**		**.33**	**<.001**		.03	.31
Intrusions	.14		.22	.03		.80	–.01		.94	–.04		.75
Distractions	.20		.06	**.29**		**.01**	**.36**		**<.001**	–.18		.12
Breaks	.04		.63	.15		.09	.05		.56	–.06		.95
Discrepancies	.14		.14	.02		.84	**.25**		**.01**	.74		.46
Sample 2		**.32**	**<.001**		**.22**	**<.001**		**.27**	**<.001**		**.06**	**.01**
Intrusions	.14		.06	.06		.47	.12		.12	–.02		.83
Distractions	**.29**		**<.001**	**.28**		**<.001**	**.25**		**<.01**	–.15		.07
Breaks	.07		.30	**.15**		**.02**	**.16**		**.01**	.06		.42
Discrepancies	**.22**		**<.01**	.12		.14	**.16**		**.05**	–.14		.11

Note. JAWS = Job-Related Affective Well-Being Scale. Significant predictors/models (p < .05) are presented in boldface.

support in Sample 2 ($p = .01$). Hypotheses 2a and 2b suggested that perceived breaks would be positively correlated with psychological stress outcomes and negatively correlated with well-being, respectively.

Results support Hypothesis 2a, finding that in both Sample 1 and Sample 2, breaks are positively correlated with anxiety ($p < .001$), somatic symptoms ($p < .001$), and negative affect well-being ($p < .001$) but not related to positive affect well-being ($p = .18$, $p = .47$, respectively). Hypotheses 3a and 3b suggest that perceived distractions would be positively correlated with psychological stress outcomes and negatively correlated with well-being, respectively. Results support both hypotheses, finding that in both Sample 1 and Sample 2, distractions are positively correlated with anxiety ($p < .001$), somatic symptoms ($p < .001$), and negative affect well-being ($p < .001$) and negatively correlated with positive affect well-being ($p = .03$, $p = .003$, respectively). Hypotheses 4a and 4b suggest that perceived discrepancies, a specific form of ruminations, would be positively correlated with psychological stress outcomes and negatively correlated with well-being, respectively. Results fully support only Hypothesis 4a, finding that in both, discrepancies are positively correlated with anxiety ($p < .001$), somatic symptoms ($p < .001$), and negative affect well-being ($p < .001$) but are related to positive affect well-being only in Sample 2 ($p = .003$).

To examine the combined predictive power of the four types of interruptions, we conducted four regressions per sample, regressing each outcome of interest on all four types of interruptions at once (see Table 6). Results suggest that combined, the four types of interruptions explain 20% and 32% of the variance in reported anxiety ($p < .001$) in Samples 1 and 2, respectively, 19% and 22% of the variance in somatic symptoms ($p < .001$), and 33% and 27% of the variance in negative affect well-being ($p < .001$), but no significant amount of variance in positive affect well-being ($R^2 = .03$, $p = .31$) in Sample 1 and only 6% of the variance in Sample 2 ($p = .01$). Across both samples, when all four types of interruptions were entered together, distractions consistently emerged as a significant predictor, with the other factors generally sharing enough explained variance to fall below significance as unique predictors.

DISCUSSION

As our results suggest, interruptions on the job—whether they are intrusions, breaks, distractions, or discrepancies—are significantly related to stress outcomes and, to a lesser extent, well-being. Specifically, these findings lend support to the notion that the subjective experience of interruptions is an important predictor of stress outcomes. These results held in a diverse working student sample as well as a sample

of working engineers. This is good news for researchers and practitioners alike, indicating that the 20-item measure may predict a large portion of the variance in stress outcomes. Our study also lends support to the theoretical distinctions between different types of interruptions, outlined by Jett and George (2003) and further defined by our four-dimensional model. Specifically, we found that the conceptual distinctions between intrusions, breaks, distractions, and discrepancies held up when individuals were asked to consider their subjective experiences with interruptions. These results must, however, be interpreted with caution given the lack of strong model fit for our CFA.

Limitations

This study does face certain, distinct limitations. Specifically, our data are all cross-sectional; thus, we cannot infer causation regarding stress but simply that stress is correlated with interruptions. Also, common method bias and the cross-sectional nature of the study may have inflated the predictive power of our measure. Future studies should address this limitation with longitudinal, multimethod designs. These studies also may be able to better tease out the relationship between interruptions and positive outcomes previously found (e.g., Helton & Russell, 2015, 2017). Further, our items regarding technology-based interruptions failed to load well onto our four factors. This might suggest that individuals perceive technology-based interruptions as inherently different than interpersonal or environmental interruptions. Thus, technology-based interruptions provide an avenue for future research. Because our final four-factor model, although fitting the data the best, still had poor fit indexes, future studies should examine other structures or theoretically meaningful distinctions between types of interruptions. Given the nature of our study we were unable to compare the subjective experience of interruptions with the objective experience, which would provide further information regarding the process of how interruptions lead to stress outcomes. Future studies may also work to better explore how the entire domain of ruminations empirically fits into this model, rather than the subset of discrepancies proposed by Jett and George (2003) and adapted by this paper. Additionally, we must recognize the limitations of our SMEs. Although they did have training in measurement and work psychology, they were doctoral students. Future studies should examine whether interruptions researchers have different conceptualizations of the content and the items included in our measure.

Practical Implications

Overall, our study lays the groundwork for future studies regarding the effects of interruptions on a variety of outcomes, including stress. We have provided a comprehensive definition of interruptions and created a well-defined, four-factor model by adapting the taxonomy of interruptions set forth by Jett and George (2003). Furthermore, we have developed a short, 20-item measure to provide researchers and practitioners with a tool to assess the subjective experience of the full range of interruptions proposed by Jett and George (2003). By defining the interruptions domain and providing measurement tools, we hope to improve and encourage future research in this area.

As our literature review suggests, one domain that might particularly benefit from this work is health care. Given the high rates of interruptions in many health care settings (Chisholm, Collison, Nelson, & Cordell, 2000) and patient privacy issues associated with observational methods, our scale may provide health care managers and researchers with a solution to better understand the subjective experience of interruptions within their organizations. Additionally, since our model, and subsequent scale, define and capture the perceptions of four types of interruptions, researchers will be able to discern more nuanced relationships between care provider experiences and outcomes of interest like patient satisfaction or sentinel events.

Overall, our work adds to both theory and practice in many ways. First, we synthesized two dimensions of interruptions (i.e., internality versus externality, degree of multitasking) to provide a clear definition of the general phenomenon of interruptions as well as each of the subdomains created within our two-factor model. Second, we developed a scale to measure perceptions of interruptions, allowing for a rapid assessment of a more proximal predictor in the overall interruptions process. Last, we

established correlational relationships between each of the four domains of interruptions and stress outcomes, thus laying the foundation for future studies to examine the relationship between the interruption domains and stress or other outcomes of interest over time.

APPENDIX

Short Interruptions Scale–Four Factors

Scale Responses

1: Never; 2: Very Rarely; 3: Rarely; 4: Occasionally; 5: Frequently; 6: Very Frequently

In the **past week** how often have you experienced the following at work?

Intrusion Frequency

1. Interruptions from other people prevented me from working on my task.
2. **Other people prevented me from making progress on a task I was working on.**
3. **Unexpected demands from others stopped me from getting any further in the task at hand.**
4. **I was pulled away from my work by other people.**
5. Others did not stop me from getting my work done.[R]
6. I was not interrupted by unexpected visits or demands from other people.[R]
7. **I could not continue the work I started because of interruptions by others.**
8. **Interruptions from coworkers kept me from tasks I had started.**
9. I stopped working to deal with a work emergency.
10. I had to stop working on my task to help a coworker with their task.
11. I was interrupted from my task because I answered a text/instant message.
12. I stopped working on a task to answer a phone call.
13. I received an e-mail that I had to stop what I was doing and answer right away.

Distraction Frequency

1. There was a distraction such as a noise while I was completing my task.
2. Things in the environment unrelated to my work (e.g., music, images, smells) occurred while I was working on my task.
3. **It was hard to keep my attention on my work because of distractions in my workplace.**
4. I experienced long periods of time where I wasn't distracted from my work.[R]
5. **My thoughts were pulled away from work by things around me.**
6. I was able to keep my mind on my work because there were no distractions.[R]
7. **Nearby coworker conversations distracted me from my task.**
8. Focusing on work was challenging because of distractions in the workplace.
9. Although I did not stop to answer them, e-mail notifications distracted me while I tried to complete my task.
10. Although I did not stop to answer them, text message notifications distracted me from my work.
11. **Things in the environment unrelated to my work (e.g., music, images, smells) drew my attention away from my work.**
12. **A noise or other distraction interrupted my workflow.**

Break Frequency

1. I took a scheduled break during my work.
2. **When completing a task, I chose to take a quick break.**
3. I switched to a simple task as a break from my complex task.
4. **I chose to physically walk away from my task for a moment.**
5. I finished my work without taking a break.[R]
6. I worked, without choosing to stop, on tasks until they were finished.[R]
7. **I decided to stop working on a task for a brief time.**
8. **I took a mental recess when I needed time away from a work task.**
9. **I made myself leave my task for a few a minutes before returning to it.**
10. I chose to answer e-mails as a break from my primary task.

Discrepancy Frequency

1. My tasks went as planned.[R]
2. **I had a plan of action for my work, but things changed unexpectedly.**
3. All of my tasks went as expected.[R]

4. There were no unexpected surprises while completing my tasks.[R]*
5. **My task changed unexpectedly.**
6. While I was working, the nature of my task changed.
7. A task required less work than I was planning on.
8. I found out my task was unnecessary or redundant.
9. I had to do more than I thought I would for a task.
10. I found that my task had already been done by someone else.
11. **New, unexpected information about my task became available.**
12. **My task did not proceed in the way I envisioned it would.**
13. I found an unexpected change in my work task distracting.
14. When I expected a task to go one way and it didn't, I focused on what was different.
15. **A change in my work task threw off my plan.**
16. I focused on changes in the task, rather than the task itself.

Note. Items in boldface were included in the final scale.

[R]Reverse scored.

*Item not included due to poor content validation.

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KEY POINTS

- Interruptions are events with either an internal or external impetus that completely or partially arrest engagement with a primary task.
- The subjective experience of four types of interruptions (intrusions, breaks, distractions, discrepancies) can be measured using a short, 20-item measure.
- Intrusions, breaks, distractions, and discrepancies are significantly related to stress outcomes and, to a lesser extent, well-being.
- Distractions account for variance in stress outcomes above and beyond the shared variance accounted for by the other three types of interruptions.

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