Affect Infusion in a Computer Based Multitasking Environment: An Empirical Investigation

Completed Research Paper

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Abstract

We studied the affect infusing capability of multitasking (by task switching) in a computer based environment. Our central thesis is that multitasking places increased cognitive load and cognitive switching costs on individuals leading to affect infusion during cognitive processing. These effects become magnified and negatively valenced when individuals demonstrate lower self efficacy in the use of the software mediating the multitasking activity. The results of our empirical analysis confirm our thesis. Participants showed increased arousal under the multitasking condition compared to the non-multitasking condition. Lower self efficacy magnified the negative effect of multitasking on unpleasantness. Implications of our study are discussed.

Keywords

Multitasking, task switching, affect infusion, environment psychology, stimulus-organism-response model, negative affect, cognition, arousal, pleasantness, software self efficacy, MANOVA

Introduction

In an increasingly IT-ized world, the focus on productivity and the progress made in productivity enhancing software and digital devices such as electronic mail, office productivity software, instant messaging, PDAs, and smart phones means that information workers are facing increasingly demanding workloads. To compound the problem, budget cuts and layoffs leave many companies struggling to do the same amount of work with less people. Consequently, many workers are faced with increasing workloads due to the greater volume of tasks and responsibilities. This condition exists in both small start-up companies and large organizations, where information work is typically characterized by involvement in numerous different projects, initiatives and workgroups. Involvement in multiple work spheres itself is facilitated by IT. Participants use IT for communication (e.g. email or instant messaging), coordinating work through document sharing and group collaboration systems, and for performing a variety of tasks by using a variety of office productivity systems (e.g. word processing system, database management system, spreadsheet software, project management system, search engines, and presentation/illustration software). Managing multiple tasks by switching between a plethora of tasks (typically using many different types of information technology) is a part and parcel of the modern office worker's daily work life.

The ability to manage and execute multiple tasks (either concurrently, or simultaneously by repeatedly switching between tasks), which is often referred to as multitasking, is an impressive aspect of the human cognitive system. In some situations, multitasking is nearly effortless (e.g. walking and talking) (Fisch, 2000; Lang, 2000); for other situations it is difficult or even impossible (e.g. listening to one sentence while reading a different sentence)(Broadbent, 1958). Cognitive psychologists attribute this disparity in multitasking ability to processing bottlenecks caused during the various stages of perception, cognition, and motor processing (Broadbent, 1958; Pashler, 1994). These studies emphasize that as long as the resources (perceptual, cognitive, or motor) required for two concurrent tasks are available and not being simultaneously used (resulting in a deadlock and subsequently a bottleneck), two tasks can take place concurrently. Thus, jogging and listening to music concurrently can occur seamlessly as it utilizes two different resources (motor and aural perception), but driving and texting concurrently is very difficult as it utilizes the same resource (visual perception). Numerous researchers have studied the effects of multitasking by task switching (Burgess, 2000; Pashler, 1994). Rubinstein, Meyer, and Evans (2001) found evidence of reduced productivity while multitasking between different types of tasks. Schweickert and Boggs (1984) used cognitive scheduling theory and found that the ability of people to switch between multiple cognitive tasks is limited by the capacity of the central mechanism. Similarly, Schumacher et al. (1999) studied how people performed when they switched between perceptual, motor and cognitive tasks and found that perceptual and motor tasks slowed down when they were performed with cognitive tasks. While productivity and reduced throughput of multitasking individuals is of significant interest to managers, other lesser researched effects such as anxiety (Igbaria and Chakrabarthi, 1990), negative affect (Carver and Scheier, 1990), and techno-stress (Arnetz and Wilholm, 1997; Ragunathan et. al., 2008) are increasingly becoming of greater concern as these factors have been related to greater turnover, burnout, job dissatisfaction, and lower organizational commitment (Brod, 1984; Ragunathan et. al., 2008). In this research paper we take a small step towards understanding how multitasking between cognitive tasks contributes to potentially negative affective artifacts. Our aim is to demonstrate the occurrence of affect infusion when individuals switch between, or multitask, computer mediated tasks. We also test whether negative affect infusion is magnified when an individual is low in software self efficacy. In the interest of brevity our present investigation only attempts to bridge the gap between multitasking and affect infusion, leaving a more exhaustive treatment of this subject for another forum.

The rest of the paper is organized as follows. First, we discuss the literature on multitasking and affect infusion. Using a theory informed approach we frame a research model based on the environment psychology framework and propose a set of testable hypotheses. This is followed by a description of our methodology, data analysis, discussion of the results, and a brief conclusion.

Theory

Theories on Cognitive Processing in a Multitasking Context

Threaded cognition (Salvuci and Taatgen, 2008) is a theory of concurrent multitasking - i.e. doing two or more things at once. It falls within the framework of the adaptive control of thought - rational (ACT-R) cognitive architecture. Like the ACT-R, the basic assumptions of threaded cognition aim to specify the organization of the brain as a system of modules working together to produce human cognition (Anderson, Matessa and Lebiere, 1997). The first assumption of threaded cognition (TC henceforth), is that an individual's ability to process a task depends on the processing resources available to him. There are three processing resources - perceptual, motor, and cognitive. The perceptual resources acquire information from the external world and include systems that facilitate visual, tactile, auditory, taste, and olfactory perception. Motor resources enable individuals to act upon the external world by performing physical actions, and in some instances to enable perceptual resources (such as to move eyes). Cognitive resources process the information entering through the perceptual resources and guide further perception or motor action based upon this processing. Each resource has two components - a module that performs the processing related to that resource, and one or more buffers that serve as the conduit between the resource and the procedural resource (described later).

According to the second assumption of TC, cognitive resources are characterized as being two separate resources - declarative and procedural, and can function independently of one another. The declarative resource represents the mechanism that allows for access of information from declarative memory (i.e. long term storage where static information such as learned rules and memorized facts are stored) while accounting for the effects of learning, decay, and retrieval failures. The procedural resource uses goal directed rules to integrate and map all currently available results of resource processing into new requests for further resource processing. According to the TC theory, multiple tasks (or the goal of each task) can be represented as threads of processing coordinated by the procedural resource. Depending on the frequency of use of the procedural and peripheral (perceptual, motor, and declarative) resources, the tasks performed while multitasking may interfere with one another causing delays in processing, lower throughput, and deterioration in performance. When two tasks require the procedural resource for cognitive processing or when the two tasks are performed over a period spanning minutes or hours, the human cognitive processing system employs a task switching mode. The theory on task switching is explained below.

The theory on task switching is congruent with threaded cognition with the exception that instead of multiple concurrent threads, task switching involves a sequence of single threads executing one after the other (Salvucci and Taatgen, 2008). Models based on task switching and involving serial cognitive tasks have been shown to be more efficient and flexible in explaining cognitive processing in humans (Sohn and Anderson, 2001). In instances where cognitive processing occurs by task switching, the procedural resource is employed in servicing each task. The other resources (perceptual, motor, and declarative) are used by the procedural resource in the servicing of the task. When an interruption requiring a person to switch from one task to another occurs, cognition incurs a switching cost. Two sources of switching cost have been proposed in literature. The first source of switching cost comes from the extent of readiness of the procedural resource to perform the upcoming task (Rogers and Monsell, 1995). This means that when a new task begins the procedural resource must prepare for the execution of this task by collecting information regarding the goal of the task and accessing the specific knowledge required for the task (e.g. from the declarative resource). The switching cost incurred in ensuring readiness has been measured as the latency in time taken by users to perform unique versus repetitive tasks (Rogers and Monsell, 1995; Allport, Styles, and Hsieh, 1994; Sohn and Carlson, 2000). The second source of switching cost comes from task-set inertia, i.e. the persistent activation from a previous task (Allport and Wylie, 1999). Thus, a person experiences degradation in performance of the second task while the cognitive activation due to the first task slowly decays. Latencies in task performance due to persistent activation have been observed in experiments (Allport and Wylie, 1999, 2000; Wylie and Allport, 2000).

Affect Infusion

Louis and Sutton (1991) provide an active cognitive processing explanation for how people adapt when they switch tasks. According to them when people encounter new tasks they try to apply their existing schemas to the new context to make sense of the new task. In activating the schema appropriate for the new task some people suffer a 'holdover effect' because of the schema used for the previous task. In the activation of the schema appropriate for the new task it is suggested that people begin active cognitive processing by increasing awareness and attention to the task specifics and context. A schema is described as “an abridged, generalized, corrigible, organization of experience that serves as an initial frame of reference for action and perception” (Weick 1979, p. 50). The process of activation of the new schema, however, is a process of transmutation from an existing schema to one with numerous cognitive gaps or holes; or moving from a schema with greater certainty (perhaps having being used recently) to another with far less certainty. Thus by forcing migration from more certain to less certain work-in-progress schemas, new tasks create uncertainty and a corresponding emotional response.

Dervin (1983) describes the phenomena of sense making which is of some relevance to our discussion. According to her, human thinking and sense making is a user's constructive activity of finding meaning from information in order to extend his or her state of knowledge on a particular problem or topic. Humans use thinking and sense-making for problem solving. Sense-making in this view is seen as an information seeking endeavor in which a person is forming a personal point of view by actively finding meaning in information which fits in with what he or she already knows in the early stages. The presence of complex information or information that does not fit in with existing knowledge is seen as a source of anxiety and uncertainty. According to this view, for problem solving, information seeking is integral in the process of sense-making and depends on the effectiveness of information retrieval, integration of new information into the user's existing, schema and evaluation of the usefulness of the information for the resolution of the problem (James 1983; Hall 1981). The process of information seeking to create a schema for problem solving is a source of affect infusion (Dervin, 1983; Ingwersen 1982).

Kelly's (1991) personal construct theory describes the affective experience of individuals involved in the process of constructing a schema from the information they encounter. Kelly depicted the process of construction as occurring in phases experienced by individuals as they build their schema by assimilating new information. New information is assimilated in a series of phases beginning with confusion which increases as inconsistencies and incompatibilities are confronted within the information itself, and between it and the constructs presently held. Confusion mounts, frequently causing doubt in the validity of the new information. The affective state (confusion, leading to doubt and anxiety) of the individual figures prominently in this conceptualization.

Forgas (1995) describes affect infusion in terms of four factors: personal variables (such as personality traits, processing capacity, affective state), task characteristics (familiarity, typicality, complexity), situational features (demands, publicity, scrutiny), and four information processing strategies (direct access, motivated processing, heuristic processing and substantive processing). According to Forgas, each factor influences one another i.e situational factors and task characteristics can elevate levels of anxiety (affective state) in individuals, and anxiety in turn can affect which of the information processing strategies is used. The key take away from Forgas' affect infusion model is that personal differences, task characteristics and situational features can cause affect infusion in predominantly cognitive tasks.

Taken together, the literature on multitasking and affect infusion informs us on how multitasking leads to affect infusion. The salient points of our argument are summarized as follows:

1. Humans have a cognitive procedural resource that is goal directed and is involved in the goal directed processing of many tasks. The other peripheral resources aid the procedural resource in cognitive processing.

2. When two tasks involve cognitive processing and occur over a period of minutes or hours, the human processing systems utilizes sequential threaded cognition.

3. When multitasking occurs due to interruptions, i.e. a second task begins before the first task has ended, cognitive processing incurs a switching cost. The first switching cost occurs as a result of the procedural resource's need to orient itself to the goals and information required for the second task. The procedural system accomplishes this by constructing a schema for the second task. The process of constructing a schema is the process of moving from a less certain to a more certain state of information. This process opens avenues for affect infusion.

4. The second switching cost, i.e. task-set inertia, serves as additional resistance in the process of creating the second schema, possibly leading to affect infusion. Affect infusion also depends on individual factors, e.g. self-efficacy.

Research Model and Hypotheses

Environment Psychology Model

The environment psychology model proposed by Mehrabian & Russel (1974) is the preferred affective lens used for understanding affective phenomena. The environment psychology model (also known as the stimulus-organism-response or S-O-R model) has been widely used in marketing research to study the relationship between features of the retail environment and consumer behaviors. The central premise of the S-O-R model is that emotions function to mediate the effects of environmental stimuli on behavior. It assumes that people's emotions determine what they do and how they do it, and that people respond with different sets of emotions to different stimuli. The emotions in turn induce individuals to approach or avoid these stimuli. In the context of this study multitasking is the stimulus, and the emotional evaluation of the stimulus by actors represents the organism. The corresponding action of actors i.e. approaching or avoiding multitasking behavior represents the response but is not included in the present research model.

Lang's (1994) dimensional theory of emotion is central to understanding the role of emotions in the S-O-R model. The dimensional theory of emotion describes emotional space as being comprised of the two dimensions of arousal and valence (Lang 1994, Lang 1995). Within this theory, a given stimulus is classified in terms of how arousing it is and how positive or negative it is (Lang 1994). Arousal is described in numerous ways in literature. In neuropsychology it is described as a "de-synchronization of the neo cortex induced by any one of a variety of afferent stimuli or by direct excitation of the activating mechanism in the brain stem that is invariably associated with the concomitant appearance of an undulating series of large slow waves in the hippocampus" (Green et al. 1954). In the fields of human learning and psychology arousal is described as an elevated sense of bodily function (Eysenck 1976), a response to increase in task complexity (Berlyne 1960), and as a state of being wide awake, vigorous and excited (Thayer 1978). Russell & Barrett (1999) define it as "the subjective experience of energy mobilization for psychological and motor activity". We refer to arousal as defined by Whissell et al. (1986) as "the nonspecific component of emotional response that reflects the intensity rather than the evaluative quality of affect". In contrast to arousal, which is a non-directional component of emotion, valence is directional and measures emotional response ranging from positive to negative (Russell 1980) and is described subjectively as pleasantness or unpleasantness (Barrett 1998).

The dimensional theory of emotion suggests two primary motives that underlie all affective responses: the appetitive system and the aversive system. The appetitive system is associated with consummatory and nurturing tendencies and manifests itself as the behavioral response of approach. The aversive system is associated with protective and defensive tendencies and manifests itself as the behavioral response of avoidance. Thus, according to the dimensional theory of emotion, people approach a stimuli and persist interacting with the environment when a stimulus is perceived as pleasant. On the other hand, people avoid and distance themselves from the environment when the stimulus is perceived as unpleasant. Lang (1995) proposes a biological evolutionary explanation for the dimensional model of emotion. According to him, the action dispositions and their physiological manifestations are linked to nodes in the brain that represent attributes of the emotion eliciting stimuli. In this way fundamental attributes (such as size and color) and cognitively perceived attributes such as complexity can influence emotional responses.

When faced with interruption based multitasking, individuals may perceive the situation to be high in complexity (Dervin 1983, Kelly 1991) and thus requiring substantial cognitive processing. Prior research has consistently shown complexity to be positively related to arousal (Berlyne 1960; Gilboa and Rafaeli 2003; Heath et al. 2000; Mummalaneni 2005). The diverse and numerous cues provided by the perceived complexity while multitasking causes actors to devote considerable attention and time to comprehend it. It thus serves as a source of stimulation and interest which provokes more energy mobilization and higher levels of arousal in individuals (Kaplan 1983, Gilboa and Rafaeli 2003, Heath et al. 2000). Thus,

H1: Multitasking is positively related to arousal.

In studying the effect of multitasking on pleasantness we delineate software self efficacy as the individual difference factor of interest. Software self efficacy (SSE) refers to individual's feeling of self-efficacy relative to a specific software package. Thus, SSE is a "particularized judgment" as opposed to an omnibus feeling of efficacy related to the broad task of computing (Agarwal, Sambamurthy and Stair, 2000). From Forgas' description of affect infusion we know that individual differences account for differences in affect infusion among individuals while performing a task. Taking a schema point of view, we expect a person with higher software self efficacy to possess better pre-existing schemas and declarative knowledge (Martocchio, 1994) that can be used for problem solving using the specific software. Such individuals are better able to construct the schema required for a new task as they do not have to begin from a lesser evolved schema, compared to people with lower specific self efficacy. In other words, a person's ability to use a software influences the extent of cognitive processing they must employ to successfully execute a task using that software. Those with lesser ability must use cognitive resources not only for learning the software but also to process the requirements of the task. Thus, people with lower SSE will experience greater cognitive load resulting in higher negative affect infusion compared to those with higher SSE. Thus,

H2: Software self efficacy (SSE) moderates the relationship between multitasking and pleasantness such that, when SSE is low, multitasking has a strong negative relationship with pleasantness. When SSE is moderate or high, multitasking has a slight negative or statistically insignificant relationship with pleasantness.

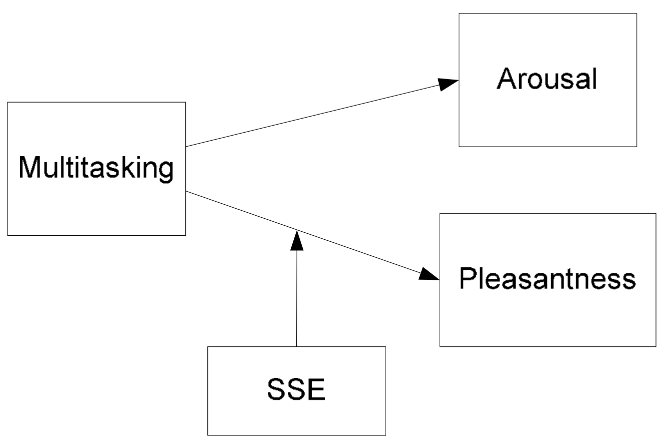

Figure 1. Research Model

Method

The research model was tested using a laboratory experiment. We devised two excel tasks, and manipulated the levels of multitasking by asking one set of participants to perform the two tasks sequentially (i.e. begin the second task only after completing the first task), and asking another set of participants to toggle between tasks 1 and 2 after three minute intervals. The second set of participants was considered as multitasking by interrupted task switching in our experiment and the multitasking variable for this set was coded as 1. The first set was coded as zero or 'not multitasking' for the multitasking variable.

Excel Tasks for the Experiment

We created two simple excel tasks for our experiment. The first task involved using excel to manually calculate the standard deviation of a data set containing six numbers. The second task involved using excel to construct a simple pie chart given a data set of 10 inventory items (bread, eggs, and milk). The steps involved in each task are tabulated in table 1.

Task 1 - Calculating the Standard Deviation	**Task 2 - Making a Pie Chart**
1. Enter the six numbers in a column 2. Use formula to calculate the mean 3. Use formula to find the difference between each of the six numbers and the mean and store the calculated values in a separate column 4. Square the values from the column in the previous step. Store them in a separate column 5. Use formula to add the squared values. Store value in a separate cell. 6. Divide the sum of squares by 5 (i.e. the number of data values minus 1) 7. Use the square root function to calculate the standard deviation.	1. Create a column with the three item labels in each row (bread, eggs, milk), 2. In the adjoining column next to each label enter the frequency count of each item 3. Convert the frequency counts into relative frequencies 4. Use the excel chart utility to plot the chart.

Table 1 - Suggested Steps for Excel Task

Sample and Experimental Procedure

The sample for our study was composed of undergraduate students from two large universities in southern United States. Students voluntarily participated in this study in exchange for extra credit. We used student subjects for two reasons. First, given the non-trivial sample size required for this study, students provided an accessible sample. Second, the use of student sample does not detract from the generalizability of our findings as there is little reason to believe that students' emotional response mechanisms differ from those of other groups of people (Panksepp, 1992). In all, 147 students participated in our study, and yielded 142 usable data points for our study. 5 data points were discarded due to missing data or failure to follow the instructions.

The experiment was carried out in six business statistics classes in two universities. Students were instructed to bring their laptops to participate in the experiment. Three classes performed the two tasks in a sequential order, i.e. no multitasking, and three classes performed the two tasks by toggling the tasks every three minutes. The time limit between interruptions was based on the time taken by students to complete each task in our first business statistics class. The students in this class received the no multitasking treatment and completed task one in an average time of approximately seven minutes (the minimum recorded time for task 1 was 5 minutes and 30 seconds), and completed task two in an average time of approximately five minutes (4 minutes and 15 seconds minimum). At the beginning of each experimental session, students were provided instructions regarding their tasks. Prior to conducting the experiment, students completed a survey questionnaire to measure their excel self efficacy. We used an adaptation of Agarwal et al.'s (2000) measure of software self efficacy to measure excel self efficacy. The students were given a paper sheet with task one on one side and task two on the other. For classes subjected to the no multitasking treatment, we instructed students to perform one task and proceed to the second task only upon completion of the first task. For classes that were given the multitasking treatment, we instructed students to begin task one. After three minutes had elapsed we instructed students to save their progress on task one and begin working on task two. This process was repeated until each task had received at least one interruption. The experiment was continued until fifteen minutes had elapsed from the start of the experiment or the student had completed both tasks, whichever occurred first. Upon completion of the experiment, the students completed a survey questionnaire measuring arousal and pleasantness. We used an adaptation of Mehrabian and Russell's (1974) measures of pleasantness and arousal in this study.

Analysis and Results

We conducted a confirmatory factor analysis using maximum likelihood to assess the factor structure of excel self efficacy, arousal and pleasantness. The three-factor model yielded a CFI of 0.91 and a SRMR of 0.038. This indicates that the model fit well (Hu and Bentlre, 1999). All factor loadings were significant ($p<0.001$) and ranged between 0.71 and 0.91. The composite reliability of each factor ranged from 0.82 to 0.95 and thus demonstrate acceptable factor reliability. As the psychometric properties of our instruments were valid and reliable we summed and averaged the items for excel self efficacy, arousal and pleasantness to get a single score for each variable.

We conducted a MANOVA analysis to examine the effect of multitasking on arousal and pleasantness. The Box's M test, testing the null hypothesis that the covariance matrices of the dependent variables are the same across groups, was not significant ($p>0.05$), ensuring compliance with the equal covariances assumption of MANOVA. An interaction variable to measure the effect of the interaction between multitasking and excel self efficacy was also included in the model as a predictor. Significant multivariate effects were found for multitasking and the multitasking by excel self efficacy variable (see table 2).

Variable(s)	**Pillai's Trace**	**Wilk's Lambda**	**Hypothesis df**	**Error df**
Multitasking	0.759***	0.241***	2	137
Multitasking * Excel Self Efficacy	0.602***	0.398***	2	137
Excel Self Efficacy	0.403*	0.597*	2	137
Note: *, ** & *** represent significance at p<0.05, p<0.01 & p<0.001 levels respectively.				

Table 2. Multivariate effects

We then conducted a univariate test and found the effect of multitasking to be significant for arousal [mean arousal increased for multitasking group by 2.13, $F(1,138) = 5.457$, $p < 0.05$], and a significant interaction effect between multitasking and excel self efficacy for pleasantness [$F(1,138) = 4.493$, $p < 0.05$]. The result of this test confirms hypothesis 1 that multitasking was associated with greater arousal. The significant interaction effect suggests that the effect of multitasking on pleasantness depends on the excel self efficacy of the participants. To examine the effect of multitasking on pleasantness in the low, moderate and high excel self efficacy conditions, the data was split by excel self efficacy. To create the three groups for excel self efficacy we calculated the mean (4.1) and standard deviation (1.9) of our excel self efficacy scores. The high group consisted of students with scores of 6 or more (mean plus one standard deviation). The moderate group consisted of scores between 6 and 2.1 (i.e. mean score minus one standard deviation). While the low group consisted of scores below 2.1. The results of the univariate analysis are tabulated in table 3.

Our univariate analysis of the interaction confirms hypothesis 2. Excel self efficacy moderates the relationship between multitasking and pleasantness. The low self efficacy group showed a significant negative relation with pleasantness (-0.646, p <0.01) for the multitasking treatment. In comparison, the high and moderate software self efficacy groups showed a milder negative relation with pleasantness (See table 3. The difference in pleasantness is -0.304 for moderate SSE, and -0.106 for high SSE). Both relations were also statistically insignificant.

Dependent Variable	**Phase**	**df**	**Error df**	**Difference in pleasantness (Multitasking group - No Multitasking group)**	**F**	**Treatment Condition**	**Mean Value of Pleasantness**	**Std Error**
Pleasantness	High self efficacy	1	49	-0.106	1.944	Multitasking	0.172	0.054
						No Multitasking	0.279	0.052
	Moderate self efficacy	1	62	-0.304	2.362	Multitasking	-0.101	0.053
						No Multitasking	0.203	0.049
	Low self efficacy	1	31	-0.646**	7.979	Multitasking	-0.504	0.022
						No Multitasking	0.142	0.024
Note: *, ** & *** represent significance at p<0.05, p<0.01 & p<0.001 levels respectively.								

Table 3. Univariate Tests for Interaction Effect

Discussion and Conclusion

Does affect infusion matter in IS phenomena? We argue that it does. Using IT has become a part of our daily lives whether it be responding to emails while at home, or conducting a quick search query while working on a report at work. As individuals reap the benefits of increased productivity by using IT, they also face numerous scenarios where they must switch from one task to another task while using an IT artifact. We argue that task switching forces individuals to un-focus, retrain focus on another task, and then perform that task. This multitasking by task switching has switching costs which by our reckoning places an affective strain on individuals. Our study takes a very small and preliminary step in detecting evidence of affect due to multitasking. Using an affective lens we found that multitasking indeed causes a noticeable change in arousal and pleasantness perceptions. Multitasking was perceived as more unpleasant by participants who were low in software (excel) self efficacy, suggesting that lack of training magnified the negative effect of multitasking.

Prior research has always purported the existence of a significant link between multitasking and the human affective system even in primarily cognitive tasks (Jeong and Fishbein, 2007; Wang and Tchernev, 2012). Our findings are fairly commensurate with the postulates of this prior research. For instance, Wang, Lang and Busemeyer (2011) show that the affective system is activated dynamically in response to environmental stimuli (e.g. multitasking). Two important characteristics are suggested. First, the affective systems do not activate and deactivate immediately, i.e. the activation and deactivation of these systems after the onset and disappearance of stimuli requires time (Wang, Morey & Srivastava, 2012). Second, the effects of activation are cumulative. This is because the decay of activation in the system requires time, and thus exposure to a new source of stimuli causes increased activation of already active systems (Wang et al., 2011). The implication is that repeated activation of the affective system, as was performed using the multitasking treatment, can cause an accumulation of negatively valenced emotions. This is especially true when no intervening period for deactivation is allocated between multiple tasks. Our study successfully measures the presence of the negatively valenced emotions in the multitasking condition.

Hypothesis	**Support**
H1: Multitasking is positively related to arousal	Supported*
H2: Software self efficacy (SSE) moderates the relationship between multitasking and pleasantness such that, when SSE is low, multitasking has a strong negative relationship with pleasantness. When SSE is moderate or high, multitasking has a slight negative or statistically insignificant relationship with pleasantness.	Supported**
Note: *, ** & *** represent significance at $p<0.05$, $p<0.01$ & $p<0.001$ levels respectively.	

Table 4. Summary of Results

Prior research also suggests that affective state influences the retrieval and use of information from memory (Heider, 2013; Kelly 1991), quality of decisions (Forgas and George, 2001), processing style i.e. top-down (usually associated with more innovative thinking) versus bottom up thinking (satisficing behavior) (Bless, 2001; Fiedler, 2000), and sense making ability (Forgas 1998, George & Jones 1996, George & Brief 1996, Forgas & George 2001). Other studies have shown an unequivocal link between affective state and outcomes of interest to managers such as greater turnover, burnout, job dissatisfaction, and lower organizational commitment (Brod, 1984; George and Brief, 1992; George and Jones, 1996; Ragunathan et. al., 2008). Taken together, our findings suggest an avenue for examining the link between these outcomes and multitasking by using the environment psychology framework as the mediating theoretical lens.

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