A Pilot Study on Timing of Immediate Information Affects Work Performance and Langer Mindfulness Negatively Predict Work Performance

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Abstract. Instant messaging (IMing) applications are already widely used in work settings, but some argue that the intrusive nature of instant messaging can affect productivity. Langer Arian Mindfulness is considered to be associated with work performance. The purpose of the present pilot study was to explore the impact of instant messaging and Langer Mindfulness on work outcomes. Total 30 participants were recruited, a mixed design experiment was conducted, Participants were divided into a control group (do not received IMing during the task) and an experimental group (received and responded to 8 immediate messages during the task). Participants were first asked to fill out the Langer Mindfulness scale (LMS), then were asked to watch a 12-minute video and complete a test on the content of the video to test their memory of the video content. Within the experimental group, the timing of the pop out of the 8 instant messages was carefully designed to be divided into masked messages (appearing 10 seconds before the appearance of the to-be-tested message) and non-masked messages (appearing 10 seconds after the appearance of the to-be-tested message). Result indicated that for instant message effect, after controlling for subjective difficulty of subjects on the post-experiment test, only non-masked immediate information impaired subject performance, which suggested the timing sensitive of interruption. For effect of mindfulness, the LMS negatively predicted task performance. Stepwise regression showed that the Flexibility subscale of LMS negatively predicted task performance, and the higher the Langer Mindfulness, participants were more vulnerable to be affected by immediate information.

Keywords: Interruptions; Instant Messages; Langer Mindfulness; Workplace Performance.

1. Introduction

Social media has been a vital source of information and social interaction, with a majority of individual claiming that they maintain contact and relationships with colleagues, family and friends by using instant messaging (IM-ing) (Madden & Jones, 2008). However, this information can be interruptive given the immediacy of IM-ing during work hour, especially since its occurrence usually are accompanied by audio or visual notification that may have negative impact on work performance (Lebbon & Sigurjónsson, 2016). Mindfulness, described as conscious cognitive categorisation (Langer, 1989b), has been widely suggested to improve task performance (Glomb et al., 2011). This paper therefore explores how non-work related IM-ing affects work performance and the role Mindfulness plays in this process.

1.1 Instant Messaging (IM-ing)

IM-ing has been proven as an effective way for communication in the workplace (Maina, 2013). IM-ing is characterised by its immediacy, allowing multiple individuals to communicate instantly over the internet in separate locations using the smart cell phone or computer which can connect to internet as a medium. In 2013, the report shows that more than 80% of Europeans own at least one mobile phone (Carbonell et al., 2013), 2.5 billion of these IM-ing accounts are active and more than 4.7 billion IMs are sent annually (Lebbon et al., 2016).Not surprisingly, IM-ing via the medium of mobile phones is therefore becoming increasingly important in the workplace.

Individuals are reported a preference for IM-ing for its immediacy of information delivery in workplace. Compare with email and telephones, employees reported their preference for IM-ing when they need an immediate feedback or response, especially in decision-making scenarios (Spira & Feintuch, 2005). IM-ing is also considered to have a highly rewarding effect due to its immediacy.

The presence of IM-ing implies increased social connectivity which is often accompanied by visual and audio alerts (which are difficult to ignore) and the process of sending and receiving messages reflects immediate feedback (Wilmer & Chein, 2016).Overall, the popularity of IM-ing in the workplace is mainly due to the immediacy of its messaging, which increases productivity and gives individuals a reinforcing effect within the framework of behaviourism.

However, there have been complaints that IM-ing, with its intrusive and immediate nature, tends to interrupt people while they are concentrating on a task. Empirical studies have found evidence that task insertion IM-ing affects cognitive task performance(Conard & Marsh, 2014; Mansi & Levy, 2013; Wang et al., 2012). Mansi et al. (2013) recruited 15 knowledge workers as participants and asked them to complete four types of tasks, which differentiated in terms of task difficulty (simple-complex) and the sensory channel invoked (symbolic-spatial), and the immediate information inserted during the task was of three types: no interference, little IM-ing interference, and a lot of IM-ing interference, and the final task performance metrics were accuracy and completion time. The results show that the completion time for difficult tasks becomes longer as the number of IM-ings increases, which means that task performance is significantly disrupted by IM-ing. However not all studies agree with this view, as Lebbon et al. (2016) study did not reach the same conclusion. He recruited 38 undergraduate subjects and asked them to perform a simple typing task; the experiment was a between-group design and the subjects were divided into an experimental group, which would receive IMs during the task, and a control group, which would not. The IMs consisted of some simple hobby questions and mathematical operations up to 100. The results showed little difference in performance between the two groups of participants. These inconsistent results illustrate that the interference effects of IM on individuals is not stable. The external factors for individuals include the influence of task difficulty and the information properties of IMs, while for the internal factors of individuals, the level of Mindfulness is a factor worth considering.

1.2 Mindfulness

The notion of mindfulness includes two different concepts. The first is derived from Buddhism field, refers to contemplation, describing a non-judgmental awareness of individual's experience (Brown & Ryan, 2003). The second is derived from Western scientific literature, which is defined by Langer (1989a) as a cognitive style, referring to a mindset of openness to novelty. The western notion of mindfulness is consisted by four subfactors: flexibility, novelty seeking, novelty producing and engagement.

Buddhism and Western Mindfulness offers some real-world application solutions in the future. For contemplation mindfulness, research has found that mindfulness interventions are effective in improving life outcomes (Brooker et al., 2014; John et al., 2012; Wolever et al., 2012). A randomised controlled trial in the workplace recruited 239 employees to assess the effectiveness of an intervention with two stress reduction programmes (therapeutic yoga and positive thinking), the trial included a control group without the intervention. The results showed significant improvements in perceived stress, sleep quality and heart rate in both experimental groups compared to the control group (Wolever et al., 2012). Yet the Eastern construct of mindfulness is not the same as the Western construct of mindfulness, as mentioned above. The goal of the Eastern positive thinking intervention is to get the subject to focus more on the present moment, whereas the goal of the Western positive thinking intervention is to change the mindset and shape perceptions. Langer (2000) believes that the mindset can be changed to improve people's perceptions of their work and therefore their happiness at work. She believes that people react differently to the same task when it is labelled as 'work' and 'play', and that individuals may enjoy the 'play' labelled task more and therefore be more satisfied with their work and have greater performance. However, the relationship between LMS mindfulness and work outcome remains to be explored.

1.3 The Present Study

The aim of this study was to firstly explore the impact of IM-ing on productivity, secondly to explore the role of Mindfulness on productivity and then to explore if Mindfulness could predict work performance.

Two methods were utilised to test the impact of instant information on work performance. First, the intervention was carried out through a between-subjects design in which subjects were divided into an experimental group, who received an instant message during the task and were asked to respond within 15 seconds, and a control group, who received no intervention during the task. The effect of the Instant message on task performance was tested by comparing the performance of the two groups. Second, a within-subjects design for the intervention, subjects in all experimental groups will be asked to respond to eight instant messages, four of which will pop up 10 seconds before the task to-be-tested message is presented (Masked question), and four of which will pop up 10 seconds after the task to-be-tested message is presented (Unmasked question). Task performance will serve as work performance indicator. The effect of the instant messages on task performance was tested by comparing the performance of the subjects at the two sets of different timings of the instant messages. The effect of Mindfulness on task performance will be tested by a linear correlation model.

H1: It is hypothesized that individuals who received IM-ing interference during the task would have lower task performance than those who did not receive IM-ing interference during the task.

H2: It was hypothesized that if the instant message was inserted ten seconds before the key message was presented, it would significantly impair participants' memory of the key message.

H3: It is hypothesized that level of LMS mindfulness (either total or subscale scores) would positively predict task performance.

2. Method

2.1 Participants

30 participants were recruited from *PROLIFIC* platform. (*M* age = 36.9, *SD* = 14.3, one missing value;). Each participant received 8.04 euros for 15 minutes participation.

2.2 Materials and Procedure

Materials consisted of a Langer Mindfulness Scales (LMS) mindfulness scale (Pirson et al., 2012),post-experiment test and survey. The entire questionnaire will be presented through *QUALTRICS*. The experimental program is produced by *PSYCHOPY* and distributed through *PAVLOVIA*.

Participants were first randomly assigned to the experimental and control groups, and regardless of which group they were in, they were asked to first complete the Langer Mindfulness Scales on *QUALTRICS*. Langer Mindfulness Scales (LMS) have four subscales: novelty producing, novelty seeking engagement and flexibility, consists of total 21 items. Flexibility subscale consist of 4 items (items 3, 7, 11 and 16; e.g. I am always open to new ways of doing things), higher score stands for that individuals are more receptive to novelties. Novelty seeking subscale consist of 6 items (items 1, 5, 9, 13; e.g. I like to investigate things), higher scores imply a tendency for individuals to actively seek out novelties. Novelty producing subscale consist of 6 items (items 2, 6, 10, 14, 18; e.g. I make many novel contributions), higher scores imply a tendency for individuals to take the initiative to create novelties. Engagement consists of 5 items (items 4, 8, 12, 15 and 19; e.g. I "get involved" in almost everything I do), higher score means that the individual tends to be actively involved in doing something rather than passively. Seven-point Likert scale was used to collect participants response, ranging from 1 ("strongly disagree") to 7 ("strongly agree"). After reverse score of item 2, 5, 7, 8, 9, 15, 19 and 21, the sum score of items will be the final score of sub-scale and total scale (Langer, 2004). The reliability of total LMS in present experiment was acceptable (α = .737).

After completing the LMS, participants were directed to an URL to watch a 12-minute video on the science of terraforming Mars on *PAVLOVIA*. The video presents one point and argument after another at a structured pace, similar to the pace of a business meeting in a work environment. The video has been selected from YouTube on the basis of the criteria of being interesting, new, knowledgeable and not overwhelming to the participants. At the end of the video, the subject will be provided with a password to enter into QUALTRICS for the post-experiment test.

The video will be embedded in the PSYCHOPY program, the experimental program will be distributed through PAVLOVIA which embedded in QUALTRICS. The video will be presented via PAVLOVIA and an IM-ing message requiring a response from response will pop up at the bottom of the video, accompanied by a bell prompt, and the participant will be asked to answer within 15 seconds. The video will be embedded in the PSYCHOPY program and the experimental program will be distributed through PAVLOVIA. The video will be presented via PAVLOVIA and IM-ing questions will pop up at the bottom of the video, accompanied by a bell prompt, and participants will be asked to respond to the IM-ing questions within 15 seconds. Please refer to Table 1 for the IM-ing question set.

The post-experiment test consisted of 8 four-choice multiple choice questions on the content of the video that had just been watched. After completing post-experiment test, participants then were asked whether they have watched the video before, then completing a 5-item survey. To control for the effects of attention and difficulty, the survey contains 3 items about attention (e.g., I was impatient with the video) and 2 items about the difficulty of post-experiment test (e.g., It is hard for me to answer post-video question). The reliability of two scales were acceptable ($\alpha = .76$) and good ($\alpha = .83$). Both variables will therefore be included as control variables in the linear model for analysis.

At the end of the questionnaire, participants will be presented with a code to enter into PROLIFIC to prove that they have completed the whole experiment in order to receive the euro reward.

2.3 Analysis Plan

A randomization check was first conducted. An independent samples t-test was conducted to compare whether there was a significant difference between the scores of the experimental and control groups in terms of mindfulness, attention and perceived subjective difficulty of post-experiment survey.

Two steps were conducted to test the effect of IM-ing interruptions on task performance. Independent samples t-test were first conducted to test if there was a difference in the task performance between experimental and control groups. Ithen go on to test whether participants in the experimental group performed significantly poorly on "Masked question" compared to their performance on "Unmasked question".

Effects of mindfulness on task performance were tested by linear regression. Firstly, the total score of LMS scale was input, and the subjective difficulty perceived by the participants was used as a control variable to test whether the total scale of LMS could predict Task performance. Then, the scores of the four LMS scales were input respectively (stepwise method), the subjective difficulty was controlled, to test whether each LMS scale could predict Task performance.

Table 1. IM-ings question set

1. If you were in a witness protection program, what would be your new name?
2. What two languages would you like to be fluent in?
3. If you could visit anywhere in the world, where would you go?
4. If you could start a collection of one kind of item, what would it be?
5. What is the strangest thing you've ever eaten?
6. Which band sang Bohemian Rhapsody, and who is the lead singer?
7. Give me the names of 3 digital devices you love most?
8. What fashion trend do you wish would come back/ go away?

3. Result

3.1 Randomization Check

The LMS subscale and total scale scores, attention and perceived subjective difficulty of the post-experiment test were not significantly different between the experimental and control groups.

Table 2. Difference between experimental group and control group on variables

Variable	Experimental group (N = 15)	Control Group (N = 15)	t	p	d'
LMS Total Score	95.07 (10.68)	96.46 (12.85)	-0.33	0.10	-0.12
Novelty seeking	26.93 (2.84)	29.80 (5.94)	-1.69	0.92	-0.62
Novelty producing	27.00 (3.57)	26.87 (3.87)	0.10	0.25	0.04
Engagement	20.80 (3.91)	19.13 (3.83)	1.18	0.77	0.43
Flexibility	20.33 (2.53)	20.68 (3.62)	-0.29	0.75	-0.11
Attention	7.67 (2.66)	9.13 (3.73)	-1.24	0.23	-0.45
Subjective Difficulty	7.60 (1.64)	6.60 (2.92)	1.16	0.26	0.42

3.2 Effect of IM-ing Interruptions on Task Performance

Independent sample t-test show that individuals who received IM-ing interruption during the task do not show significant different task performance with those who did not receive IM-ing during the task, t (28) = -.94, p = .36. Hypothesis 1 has been rejected. However, paired samples t-tests show that the timings of IM-ing appearances have a significant negative impact on task performance, t (14) = -2.69, p = .009 < .01.

3.3 Effect of Mindfulness on Task Performance

Descriptive statistics, correlations of major study variables are presented in Table 3.

Table 3. Mean, standard deviation, alphas, and correlations for variables

Variable	Mean (SD)	1	2	3	4	5	6	7	8
1. Test performance (8 items)	3.8 (1.4)	—							
2. Novelty seeking	28.4 (4.8))	-.04	—						
3. Novelty producing	26.9 (26.9)	-.21	.44*	—					
4. Engagement	20.0 (3.9)	-.35	.40*	.44*	—				
5. Flexibility	20.5 (3.1)	-.44*	.46*	.31	.47**	—			
6. LMS Total Score	95.8 (11.6)	-.32	.80***	.72***	.76***	.71***	—		
7. Attention	8.4 (3.3)	-.03	-.10	-.31	.09	.08	-.09	—	
8. Subjective difficulty	7.1 (2.4)	-.31	-.20	-.18	.16	.00	-.09	.37*	—
Note. N = 30. * p < .05, ** p < .01, *** p < .001									

To test H3, a linear regression was computed and present in Table 4 and Table 5. Two items from the Difficulty factor were included as control variables in the linear regression model for analysis, and sum score of mindfulness was used as the independent variable to predict the test outcome. Variables are entered simultaneously into model. The model explained 22% variance in difficulty and mindfulness, the mindfulness explains 12% of variance of whole model, F (2, 27) = 3.72, p = .037. The linear regression result show that β (LMS Total) = -.04, p = .054; β (Difficulty) = -.20, p = .056.

Table 4. Model Summary

Model	R	R^2	Adjusted R^2	RMSE	R^2 Change	F Change	df1	df2	p
H_0	0.31	0.10	0.07	1.31	0.10	3.03	1	28	.09
H_1	0.47	0.22	0.16	1.25	0.12	4.07	1	27	.05
ANOVA									
Model		Sum of Squares	df	Mean Square	F	p			
H_0	Regression	5.21	1.00	5.21	3.03	.09			
	Residual	48.15	28.00	1.72					
	Total	53.37	29.00						
H_1	Regression	11.52	2.00	5.76	3.72	.04			
	Residual	41.84	27.00	1.55					
	Total	53.37	29.00						
Coefficients									
Model		Unstandardized	Standard Error	Standardized	t	p			
H_0	(Intercept)	5.03	0.76		6.58	< .001			
	Q_difficult	-0.18	0.10	-0.31	-1.74	.09			
H_1	(Intercept)	9.00	2.10		4.29	< .001			
	Q_difficult	-0.20	0.10	-0.34	-2.00	.06			
	LMS Total score	-0.04	0.02	-0.35	-2.02	.05			
Note. Model 1 = Difficulty; Model 2 = Difficulty + LMS total score.									

Table 5. Linear Regression Model Summary - T_Total

Model	R	R^2	Adjusted R^2	RMSE	R^2 Change	F Change	df1	df2	p
1	.31	.10	.07	1.31	0.10	3.03	1	28	.09
2	.54	.29	.24	1.18	0.20	7.47	1	27	.01
ANOVA									
Model		Sum of Squares	df	Mean Square	F	p			
1	Regression	5.21	1	5.21	3.03	.09			
	Residual	48.15	28	1.72					
	Total	53.37	29						
2	Regression	15.64	2	7.82	5.60	.01			
	Residual	37.72	27	1.40					
	Total	53.37	29						
Coefficients									
Model		Unstandardized	Standard Error	Standardized	t	p			
1	(Intercept)	5.03	0.76		6.58	< .001			
	Q_difficult	-0.18	0.10	-0.31	-1.74	.09			
2	(Intercept)	9.03	1.62		5.58	< .001			
	Q_difficult	-0.18	0.09	-0.31	-1.93	.07			
	Flexibility	-0.20	0.07	-0.44	-2.73	.01			
Note. Model 1 = Difficulty; Model 2 = Difficulty + Flexibility.									

A multiple linear regression was calculated to predict task performance based on four subscales of Mindfulness (flexibility, novelty, novelty producing, and engagement). After control the difficulty of post-experiment test. A regression equation between flexibility and task performance was found ($F(2,27) = 6.60$, $p = .009 < .01$; β (Flexibility) = -.44, $p = .01$; β (Difficulty) = -.31, $p = .07 > .05$). After treating the difficulty variable as a control variable, only Flexibility was a significant predictor of Task performance for all four subscales (Table 5).

4. Discussion and Limitation

4.1 Discussion

The present study found that after controlling for the subjective difficulty of the post-experiment test, IM-ing that pop-up ten seconds before the to-be-tested information in the task significantly impaired the subjects' final task performance. The higher the level of Mindfulness (especially Flexibility), the worse the final task performance. H1 has been rejected, whist H2 and H3 has been accepted.

For H1, the effect of receiving an immediate message during the task was insignificant on their overall task, a result consistent with the findings of A. However, the experimental task was a simple typing task, meaning that participants could slow down or stop the task in hand at any time after receiving an immediate message, so the correctness of the task may have been high, resulting in a non-significant intervention effect. However, for H2, in real-life work scenarios, information is fleeting. This was well modelled in the present experiment, which showed that the timing of immediate information had a significant effect on task performance, with immediate information appearing ten seconds before to-be-tested information impairing participants' subsequent correct responses to the test item.

For H3, the total score of the LMS-21 significantly predicted Task performance, however, the results showed there is a negative correlation between the total score of the LMS and Task performance, contrary to the hypothesis of H3. We further examined how much variance the LMS-21 subscale contributed to the Total score and showed that only Flexibility was a significant predictor of task performance, with 20% of the variance in the dependent variable being explained by Flexibility. It can be seen that Flexibility is the main contributor to task performance variation.

Flexibility was defined as an active state of consciousness, characterized by drawing novel distinctions and being aware of alternative perspective (Langer et al., 2000a). Rieken et al. (2016) demonstrated that trait mindfulness can positively predicts multitasking ability by conducting dual-task paradigm on 75 participants, which is contradict to the result of present study. Such result could be the result of experiment paradigms difference. Amanda et al. conducted anagrams as an experimental task, which is not a typical theme. While for the present experiment, we adopted the task of watching a video and answering questions about it to simulate a life scenario. This task required the participant's continuous attention on the video and to ignore to-be-tested information. A high-level flexibility means that individuals are able to adapt quickly to the current environment or task at hand, which means that switching between tasks has a lower impact on individual efficiency and that individuals are able to quickly and fully engage in a new task. Therefore, in this study, individuals with high Flexibility quickly switched from "watching a video" to "responding to an instant message" and were fully engaged in responding instant message. As a result, the to-be-tested information that followed was ignored, the task performance hence be damaged.

4.2 Limitation

The research task in this study was to watch a 12-minute video, during which the experimental group was asked to answer eight questions that simulated an instant message, so this study may not be suitable for exploring prolonged disturbances, but rather for short-lived disturbances that can be quickly resolved.

4.3 Implication and Future Study

The present study is a pilot study in order to evaluate feasibility for the entire research protocol in future. The results first show that IM-ing is significantly detrimental to task performance, but is time-sensitive. Secondly, the results show a negative relationship between Mindfulness and task performance, in particular a significant negative relationship between Flexibility and task outcome. Such results point possible research direction for future research:

(1) People with high levels of Mindfulness seem to be less affected during task switching, and their good performance in multi-task tasks seems to be achieved by fast switching. But how do they perform when faced with two parallel tasks?

(2) A number of researchers have investigated the effect of task interruptions due to interference on outcome, but few of them have systematically discussed the issue of individual temporal sensitivity to interference. Although the results of the present study demonstrate that inserting an instant message 10 seconds before to-be-tested impairs task performance, it remains unclear how much time before the insertion of an instant message before it does not affect task performance. In other words, how long it takes for subjects to return to their original baseline state after a task switch and how they relate to each other could be explored in the future.

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