Managing attention and productivity in distracting mediated workspaces: a research path for multitasking in mediated environments

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ABSTRACT - The rapid shift to remote working environments due to the COVID-19 pandemic is forcing people to work in a mediated workspace that causes (in)attention and productivity issues. Previous attention research mainly revealed that divided attention and simultaneously conducting multiple tasks are cognitively harmful to task performance. In this paper however, we use a media psychology perspective to rethink the cause, process, and outcomes of multitasking, and propose a counterintuitive notion that strategic distraction could potentially be beneficial in a mediated workspace: (1) strategically adding another task can motivate people to continue their current work by stimulating emotion; (2) during the multitasking process, the additional task can "herd" attentional resources and inhibit task-irrelevant distractions; (3) new measures that evaluate the breadth of multitask processing (e.g., creativity, flexibility) might reveal beneficial outcomes that wouldn't be discovered in a single-task condition. Future directions of the multitasking research should systematically connect causes, processes, and outcomes together rather than looking at them in isolation.

Keywords: Attention, Productivity, Multitasking, Secondary task, Process, Causes and effects

Attention Issues Raised in Distracting Remote Working Environments

During the current pandemic, people are facing a rapid shift from a concrete office workplace into a distracting home workspace that is highly reliant on mediated interaction for virtual work. When working from home, people frequently switch between mediated work tasks, as well as switch between work and life. They open multiple work-related windows simultaneously on screen(s) when attending a long remote meeting or encounter work-irrelevant distractions such as TV noise. In mediated workspaces, media multitasking is inevitable, however, a common assumption is that such multitasking behaviors are cognitively unfriendly: they result in task-switch cost, dampen productivity, and that people need to close extra on-screen windows or turn off ambient media such as TV to focus on their work. It also assumes that focusing on only one task at a time is a behavior that is easy to accomplish and ensures focused attention and productivity. In this paper however, we will use a communication and media psychology perspective to rethink the cause, process, and outcomes of multitasking, and propose a counterintuitive notion why single task work mode is not always ideal and that strategic distraction could potentially be beneficial in a mediated workspace.

Research on media multitasking has established a range of effects, with negative effects of cognitive outcomes (failure of attention management, memory decrements, and weakened comprehension of information) of the content being a common theme [7,12]. Two theoretical models are most commonly used in communications and media research to explain the mechanisms of media multitasking and disrupted cognitive outcomes: the resource theories that posit limited capacity of cognitive resources within and between multiple resource pools [5,6,15]

and the threaded cognition theory [11]. Studies that use these two models to explain multitasking's direct effects on cognitive outcomes share the same assumptions: (1) cognitive resources are limited, (2) having just one task allows people to solely focus on it while adding a secondary task is distracting to the original task, (3) media multitasking is thus likely to overwhelm people because the additional task causes one to exceed the upper limit of cognitive resource availability and consequently lead to overload and insufficient processing of information.

While this focus on processing limitations has helped us understand how task performance can be disrupted when a person is exposed to an excessive workload, there seems to be a logical disconnect between this focus and understanding what motivates people to add additional tasks and workload in the first place. The following section will discuss the causes that motivate people to strategically add another task.

The causes for people to add additional task: it is motivating

Boredom has been conceptualized as a low arousal state that has low perceived stimulation that people want to get rid of [14]. Thus, boredom can be motivating. While it is a cue to leave a current task, it is also possible to ameliorate it through adding a task. Previous research on multitasking's influence on subjective task evaluations show that adding a secondary task has potential positive motivation stimulation effects or positive affective generation [2]. The Arousal theory of motivation [4,9] posits that people are driven to take actions to maintain an optimal level of physiological arousal. The assumption is that contextual factors influence our levels of arousal, and arousal caused by one initial factor may amplify the excitatory response to another factor [5,6]. For example, using excitation transfer as a commercial strategy such that a brand logo appears immediately after an emotional scene, leading consumers to misattribute their excitement elicited by the emotional scene to the brand.

Another condition that might lead to multitasking is cognitive underload, a state in which the resources available to process a message exceed the level of resources required to process that message. In contrast to overload, cognitive underload may motivate people to add additional tasks to achieve optimal load without harming performance [13]. Our recent research on cognitive underload and multitasking (Wise et al., in progress) found that adding an interesting video to a task that requires minimum cognitive load may improve people's emotional response to the underload task. Beyond simply providing emotion stimulation that motivated people to continue work, this study also revealed another benefit during multitasking: it reduces the amount of task-irrelevant mind wandering compared to a single-task only condition. This finding extends the function of an additional task from motivation to cognitive processing. Next, we are going to discuss the cognitive processes of multitasking and how people can strategically multitask to facilitate cognition.

The processes of adding a second task: it is occupying resources, in a good way

Most previous media psychology research talks about an additional task as an interference of a primary task. Researchers assume that without a secondary task, there will be no distraction or interference in the single task context, and that without distractions, people can fully focus on completing the single task itself. However, in the current mediated workspace, people don't often experience a chance to complete one single task without any distractions even

when there's no immediate secondary task at hand: email notifications keep popping up; laundry buzzers interrupt brainstorming; the interestingness of observing colleagues' home offices from camera far exceeds the interestingness of the ongoing meeting, etc. Conversely, when people are able to spend time without these additional outside distractions, they may find their single task too dull and turn their attention internally. With various distractions popping up during work hours, the existing findings that support single- or sequential-task condition compared to multitask condition is in question.

Lavie et al [8]'s load theory provides an interesting idea as to how a secondary task might not distract from the primary task but might counterintuitively serve to inhibit further distraction interference. The theory posits that attentional resources consists of perceptual load (the complexity of the sensory stimuli) and cognitive load (active control of cognitive processing, such as working memory or task coordination). The load theory [8] stipulates that increases in perceptual load is negatively associated with decreased distractor interference whereas increased cognitive load is positively related to distractor interference. The logic is that the increase in perceptual stimuli that need to be processed use all of the available perceptual resources, leaving no resources to further process perceptual distractors; cognitive load increases, on the other hand, dampen the ability of cognitive control which is used to reduced interference, and thus results in increased ability of the distractors to be noticed.

The load theory provides a mechanism that potentially favors adding a secondary task when people are working on a primary task in a distracting environment: if the secondary task is perceptually complex while not so cognitively demanding, this second task may exhaust a person's perceptual resources and further inhibit task-irrelevant distraction interference, and consequently, adding a second task in fact helps people to filter irrelevant distractions and herd scattered attentional resources to the task. We call this the potential "herding" function of adding a secondary task. This function is likely to be important in situations where people are not fully engaged in their primary task and need additional motivation or way to keep resources from becoming engaged too fully away from the primary task.

The outcomes: what outcomes are possible based on the above cause and process

There has been a lot of focus on the cognitive outcomes of media multitasking, most of them are negative (for a review, please see [7]). However, by revisiting the causes and processes of adding another task, we are able to predict opposite outcomes. This speaks to the importance of tracing back to the motivation and mechanism of multitasking when predicting what outcomes, in addition to what have already been found, are possible. While most media multitasking work have already revealed the negative effects of adding a second task on people's cognition, it looks at detriments to deep processing of one thing (e.g., memory, response accuracy, etc). However, we also need to explore potential benefits of broad processing that may be facilitated by adding another task.

Although current literatures do not form a systematic understanding of how adding a task could influence the breadth of processing, there are a few studies showing the potential of how multitasking processing could influence the breadth of people's mindset. For example, Avgerinos and Gokpinar [1] found that for surgeons, simultaneously having multiple tasks during operations can actually improve productivity compared to completing the tasks in a

focused, sequential manner. This is not because they can do more things in the same time period, but because they are able to transfer knowledge and activate learning mechanisms from additional tasks to the focal task. However, we don't know to what extent the cardiac operation case could apply to mediated working as well as other task types such as brainstorming or work requiring creative solutions. Other findings include people who frequently choose to multitask in daily life also tend to have higher creativity mentality and sensation seeking are also associated with daily multitasking propensity [3]. While we could imply from those findings that people's multitasking propensity and actual behaviors do connect with some breadth related outcomes, our next step should be to find out the specific causal relationship between additional tasks and a more flexible mindset, as well as the contextual and task factors that trigger such broad mindsets in mediated workspaces.

Discussion and Future Research

As the above discussion implies, much of the work on media multitasking has focused on a few limited outcomes without thinking about "why" and "how" such behaviors lead to these outcomes. In the current COVID-19 shift where everything about work is changing (e.g., mediated workspace, changing workflow, task delivery), the original familiar outcomes may not be applicable, and thus we should reconsider the effects of multitasking by understanding the interactions between people and mediated tasks. Choosing to add additional tasks can be seen as a result of the interaction between a person's motivation and task demand. When people lack motivation to complete their primary task, or when the task requires less workload, people may actively search for incentives to stimulate their motivation to engage in the work. This strategy is helpful when people are facing repetitive tasks (e.g., responding to a bulk of emails) or low engagement requirement tasks (e.g., when people need less contribution in a group meeting).

Understanding the mechanism of multitask processing could also be helpful for identifying conditions when strategically adding additional tasks can be beneficial. While common sense tells us adding a task could mean interference to the existing one, in the current distracting mediated workspace, people are already facing different kinds of interference. When a no-distraction environment becomes unlikely, adding another task might help inhibit novel distractions internally (e.g., mind wandering) and externally (e.g., environmental noise).

One reason that previous research on multitasking finds negative cognitive outcomes might be the use of measures that evaluate the depth of task processing. However, we can evaluate task performance from different perspectives, depending on task types. The breadth aspect of task processing could be used to evaluate tasks such as brainstorming or assignments that care about the breadth factors. Adding additional tasks strategically in these tasks might bring beneficial outcomes that wouldn't be discovered in a single-task condition.

In addition to the above considerations, *who* needs to add additional tasks and *when/why* they need to add them are important. The switch to highly mediated workspaces will highlight different strengths and weaknesses at the individual level. Previous research found that people with heavier multitasking tendences are people with attention deficits and are more vulnerable to distractors, meaning they are not able to use their own cognitive control abilities to filter non-primary task distractors [10]. This may be because they also have a tendency towards breadth (versus depth) processing. This breadth-biased processing could be a potential explanation as to

why some people actively turn to additional tasks or distraction (e.g. putting on a playlist of songs to when they need to filter task-irrelevant distractions. However, future research is required to test whether these heavy multitaskers and people who strategically add additional tasks in mediated workspaces overlap.

The opportune timing of when to add another task is important in terms of workflow design. Previous media research has frequently measured one-time task performance. However, an individual's attentional focus on a task may fluctuate throughout the task processing period, and the resource allocation and availability may change throughout time. We don't want additional tasks to jump in when not needed (e.g., at the beginning of a task, when people are more motivated to do it; or when it is too late to add the stimulation because people are already too disengaged to fully complete the task). Therefore, we plan to explore the role of opportune timing for the second task to jump in by analyzing the dynamic change of people's attention throughout task processes in a mediated environment.

While people who are now connecting to solely mediated work may sometimes be frustrated about their ability to always successfully manage their attention while working, there is the possibility of shedding light on how it may differently affect people based on the type of work being performed, their own individual work and attention styles, and the expected outcomes of the work being performed. Previous theories and studies on attention and productivity don't anticipate scenarios and demands we are presented during the pandemic as people move to mediated workspaces without it being their choice. We hope, by considering the causes, processes, and different perspectives of outcomes of multitasking, to promote additional research to explain and predict why people are experiencing attention and productivity frustrations and how they might even thrive through strategic distraction and multitasking in these mediated environments.

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