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A Theory of Media Multitasking Intensity

Abstract

This article first situates media multitasking in the changing media ecology. Then, grounded in concepts of stress and flow, limited capacity, and threaded cognition, it develops a four-dimensional theory of media multitasking intensity. Based on the key aspects of media multitasking intensity, the subsequent section proposes two primary influences (executive functioning and self-regulation) and one primary outcome (general stress). An application example focuses on several media multitasking issues and the stress outcome for adolescents within their family environment. The final section suggests a few key methodological implications for studying the theory of media multitasking intensity (self-report, and both temporal and social contexts). The theory of *media multitasking intensity* generates insights about the functional (i.e., valuable) variation within experiences of media as they overlap with and interrupt experiences of the physical and mediated world.

Key reference terms: multitasking; media multitasking intensity; executive functioning; self-regulation; stress; adolescents and family

A Theory of Media Multitasking Intensity

The evolution and profusion of devices facilitating experiences of media has transformed the role of media and media devices in society (Lang, 2013; Valkenburg et al., 2016). Today, the economic growth of organizations, cities, and countries have depended on the proliferation of information and communication technologies (ICTs) that are embedded in and related to a multitude of facets of human goals and daily life. Some aspects of digital divides are narrowing, and the global society has become dependent economically, politically, and interpersonally on these Internet-connected devices (Pew Research Center, Internet & Technology, 2018; Nord et al., 2019). Media have become assimilated into even the most basic daily goals, such as eating, sleeping, breathing, working, studying, creating, connecting with others, relaxing, and exercising. However, these changes, which have produced a high volume of social, political, health, work, and entertainment information, are also potentially troubling.

As the physical environment including homes, classrooms, organizations, and restaurants, and the digital, wired, and wireless environments are filled with more media, there is a growing and unavoidable demand to process more mediated information while learning, speaking with family members, working, exercising, and eating. Simultaneously, these multifaceted devices facilitate the creation of goals that were previously unimaginable or unattainable, and increase interference or overlap between the digital and the physical (Rice et al., 2018; Walsh, 2016). The role of media, and more frequently multiple media, within daily goals has been associated with an increased frequency of media coinciding, complementing, interrupting, supporting, or interfering with other tasks and activities. Media multitasking is conceptualized as the resource allocation that creates the concurrence or integration and competition amongst mediated stimuli or between mediated and physical stimuli. As media transform daily experiences, this has increasingly become a topic of concern (Reinecke & Eden, 2017).

Media multitasking is not directly identified as a strictly causal pathological media behavior, yet nonetheless many studies note disadvantages, harms, or costs (Table 1). Few articles address the benefits of media multitasking (Lang & Chrzan, 2015). The majority of scholarship has concentrated on its implications for cognitive functioning (Chein et al., 2017; Van der Schurr et al., 2015). Yet, as Fisher and Keene (2019) have indicated, the existing research often implicitly considers the brain as a black box, and yet implies that increased involvement of media in daily life is fundamentally transforming cognitive functioning (i.e., through neuroplasticity). Media multitasking research has often only assumed that media multitasking is a human adaptation to a changing environment. Further, scholars have lacked lucid conceptualizations of media multitasking or have not defined it within the scope of their research, creating uncertainty in the interpretations of measures and thus empirical findings.

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Thus this paper will develop and justify a theory of media multitasking *intensity* to fill existing gaps in the theoretical development, measurement, and testing of the concept of media multitasking. This discussion will begin by contextualizing the theory of media multitasking within theories of stress, flow, limited capacity and load. These existing models become the assumptions on which the causal processes and four dimensions of media multitasking intensity are developed. The subsequent section discusses core influences on, and one outcome from, media multitasking. To illustrate the applicability of the theory, a following section provides an application example involving family and adolescent media multitasking. The final section suggests a few key methodological implications, concerning data collection and contexts.

Stress and Flow as a Foundation

Common theoretical approaches to multitasking include cognitive load theory, threaded cognition, limited capacity model (LCM; LC4MP), multiple component model of working memory, LCM and elaboration likelihood model, capacity interference and structural interference, and a combination of capacity interference, processing interference, orienting responses, and physiological arousal (their Table 4.2, p. 102; Lang, 2006). Limited capacity models explain that limits in cognitive resources also limit information processing. Lang and Chrzan's (2015) literature review demonstrates existing support for limited capacity models and concludes that the two primary multitasking factors affecting performance are extent of sharing perceptual and processing systems, and difficulty of tasks.

Here, the intersection of the models of and stress and flow is the foundation for the theory of media multitasking intensity. These are generalizable or universal models of *human-environment* interactions that describe and explain the mechanisms as well as the interpretations and value of media multitasking intensity. Models of stress (Lazarus & Folkman, 1984; Lazarus, 1993) and flow (Csikszentmihalyi, 2000) evaluate individuals' resource-to-environment-created-demand ratios, while accounting for and demonstrating the critical role of human perception. These have demonstrated validity via the quality of their measures and of the theoretical claims derived from their empirical investigations. Based in theories of both evolution and psychology, these theories state that stress or flow are outcomes of human *fitness* or (in)ability to adapt to the challenges and demands of their environment.

Stress occurs due to the presence of a set of demands that challenge, exceed, and/or are at least perceived to exceed the existing set of resources (Ellis & Del Giudice, 2013; Lazarus, 1993; Lazarus & Folkman, 1984). These resources may be inherited or developed, internal or external. All of the following are considered resources that allow humans to adapt to their environment: skills, abilities, knowledge, physical health, wealth, and social capital. These resources, however, are limited and can become strained and overloaded, creating cognitive and physiological distress as is explicated in the limited capacity, bottlenecking, and threaded cognition models (Wang et al., 2015; Yeykelis et al., 2014). Flow is a state in which demands and resources are synchronized (Weber et al., 2009). Flow reflects experiences of enjoyment, fulfillment, and full attention, which are derived from the perceptions of the environmental demand creating a challenge that is potentially surmountable. The interaction between social, psychological, and biological systems creates the manifestation and impacts of stress and flow. The mechanisms of the construct of both expand beyond a stimulus-response model. Exposure to a situation or stimuli does not cause the same quantity of stress or flow across all individuals. The context or situation is only one dimension or mechanism of stress; the other is the existing availability and accessibility of resources.

Beyond physical demand and resources, these theories of stress and flow prize human perception, revealing that the manifestation of these phenomena and their subsequent effects are consequences of *subjectivity*. The state of stress and flow are traceable or have causal relationships to *subjective* experiences, or those that are mind-dependent (Maul, 2017). Thus, it logically follows that stress and flow are interpretable or meaningful in relation to individuals' perceptions of their own experiences and capacities. Lazarus and Folkman (1984) theorize that the cognitive appraisal of demands as exceeding resources not only creates but also increases the psychological and physiological experience of stress. Csikszentmihalyi (2000) similarly contends that flow is a subjective state, which may reflect both the "actual" relationship between task demand and cognitive resource, and perceptions of that relationship.

Based on theories of stress and flow, physical (i.e., physiological and cognitive) consequences follow from the perception of the demand-resource ratio. Perceptions of challenges can lead to coping, which aims to increase the resource available to meet the demand. This coping can occur cognitively via reframing perceptions, and behaviorally via applying or seeking resources. When coping or obtaining and applying resources, individuals may find that they reach a state of flow in which their resources meet the demands of the environment; in the stress literature this is often referred to as resilience (Bonano, 2004; Carver, 1989). They may even feel that they gained resources or coping capacities (i.e., strategies for obtaining or applying resources) such that they now no longer find this previously stressful situation as challenging. Experiences of flow, therefore, are associated with learning, and growing, often referred to as thriving within the stress literature. In relating this to media multitasking, the challenges or demands that are derived from a media-saturated environment may invoke coping behavior like those predicted by the "law of less work" (Wang et al., 2015). People may find these challenges surmountable if they have, or perceive having, sufficient resources. The availability of and perceptions of resources may be dynamic. These resources may develop as a result of coping skills and experiences of flow such that they reflect growth from their experiences of challenges.

In summary, the models of stress and flow provide a fundamental set of assumptions relevant to the proposed theory of media multitasking intensity: 1) experiences of tasks are consequences of the reciprocal relationships between behavior and cognition, 2) experiences of one's environment depend on demand-to-resource ratios and consequent coping behaviors, 3) challenges are not inherently harmful but are a natural and fundamental aspect of human growth and satisfaction, and 4) humans adjust their behaviors and cognition (more or less successfully) to adapt to challenges.

Foundations of the Theory of Media Multitasking Intensity

Briefly connecting the constructs, media multitasking can be framed as a perception of interactions with and adaptations to a media-saturated environment. The theory of media multitasking intensity proposes that media multitasking is a multidimensional construct involving the interaction between cognition and behavior, which varies meaningfully on both more or less *intensively*. In addition to providing discussions about the causal mechanisms of media multitasking and its effects, the theory aims to remedy existing ambiguity about the role of behavior, cognition, and the perception of cognition and behavior in the manifestation, measurement, and effects of the phenomenon. Therefore, this section will first define the more common concept of media multitasking, and then define media multitasking intensity.

Media Multitasking

Media multitasking is defined as the perception of the co-occurrence of or interference between two or more tasks, when at least one of these tasks' stimuli is a form of mediated information (i.e., media). Previous research has often extended existing cognitively based definitions of multitasking (completing two tasks concurrently, or switching in rapid succession) to media multitasking (involving a media task and a non-mediated task, or when completing two media tasks concurrently) (Table 4.1; Fischer & Keene, 2019; Lang & Chrzan, 2016; Segjin, Xiong, & Duff, 2019; Wang et al., 2016). *Tasks* are the allocation of senses such as vision, audition, tactile reception, vestibular sensation, and proprioception to stimuli. They can vary in duration but fundamentally require time for orienting to a stimulus and then applying sensory capacities to process it. This definition diverges from colloquial definitions of a task in that tasks may be neither conscious nor goal-directed. Yet, this is an important distinction given that information can be processed from a task which was expected and intentionally focused upon as

well as those that were automatic or reflexive in nature. *Media* are defined as tools through which information can be communicated, which extend communication beyond human's unaided physical capacity. *Media tasks* therefore are the allocation of senses to mediated information. *Physical tasks* are the allocation of senses to physical stimuli in the environment. Media multitasking can involve multiple media tasks alone as well as combinations of media tasks and physical tasks.

Media themselves are mind-dependent or subjective. They exist in the physical environment but are identifiable by comparing human capacity for information sharing and absorption, and tools that extend beyond human capacity. Thus, the proliferation of media and devices facilitating media increases the number of stimuli that involve information otherwise not communicable without these tools, creating an influx of potential media tasks. These stimuli also include using the media and devices themselves. Still, experiences of media tasks, like physical tasks, vary because of attributes that affect the task-demand-to-resource ratio and perceptions of that ratio.

Media Multitasking Intensity

Previous research has primarily tested whether the frequency of media multitasking (especially media co-occurrence; in particular the Media Multitasking Index; Ophir et al., 2009) demonstrated significant relationships to attentional facilities. Yet investigations of media multitasking unidimensional and extensive effects (i.e., additive) such as examining its frequency have resulted in inconsistent and inconclusive findings (Chein et al., 2017; Jeong & Hwang, 2016; Lang & Chrzan, 2015; Van der Schurr et al., 2015; Wiradhany & Nieuwenstein, 2017). Instead, the central notion of media multitasking *intensity* is derived from the conceptualization of media multitasking as a latent construct that is multidimensional. *Intensity,* therefore, is an attribute of the multiple dimensions of media multitasking: the behaviors and cognition that correspond with various forms of sensory resource allocation. Thus, fundamentally, media multitasking intensity is contextual, and cannot be represented by the most commonly used measure of frequency or percent of media co-usage (Ophir et al., 2009).

The proposed theory identifies four dimensions of media multitasking intensity (MMTI, which parsimoniously explain the variation in attributes of media and physical tasks involved in multitasking: *co-occurrence and interruption, difficulty (or task demand), intentionality,* and *relevance.* They also synthesize and reconceptualize existing media multitasking research and hypotheses into a mind-dependent, interdependent, and multidimensional model (Lang & Chrzan, 2015; Wang et al., 2015). While each dimension individually has theorized impacts on actual and perceived demand-resource ratios, they are theorized to become more influential in combination.

Their *explanatory power* is grounded in concepts of perceptual load (i.e., sensory processing) and cognitive load (i.e., effortful processing). *Perceptual load* refers to the quantity of perceptual cues or stimuli that must be processed and the relevancy among them that occurs before cognition (Lavie, 1995). Thus, perceptual load is predicted to have stronger relationships with task co-occurrence and interruption, intentionality, and relevancy than with difficulty. Task difficulty can involve the number of perceptual cues involved, but its other components are less related. In contrast, *cognitive load* refers to the attention and working-memory demand of the information that is processed (Wang et al., 2015). Cognitive load is more consciously experienced. Cognitive load is predicted to have stronger relationships with task co-occurrence and interruptions, difficulty, and relevance, than with intentionality. This is because more conscious thinking and thus intentionally can induce more focus/cognitive load, but this thinking

can lead to strategic behaviors that reduce effort involved in tasks. Figure 1 portrays these relationships.

-- Figure 1 --

Task co-occurrence and interruption involves the perceived temporal overlap or interference between multiple media tasks or between physical and media tasks. The current theory purposefully departs from cognition-only based language to focus on the subjective mind-dependent components of media multitasking. Unidimensional conceptualizations of media multitasking often only included task switching or dual tasking based on cognitive bottlenecking and limited capacity models (Lang, 2009; Lang & Chrzan, 2015; Wang et al., 2015; Yeykelis et al., 2014). However, this approach ignores perceptual and behavioral nuances. For instance, they omitted sensory integration, in which multiple stimuli or information streams are integrated and processed cohesively (Salvucci et al., 2009). Thus, *task co-occurrence* is the perception of simultaneously allocating resources to multiple stimuli, and *task interruption* is the perception of allocating resources to stimuli that interfere in the processing of and allocation of resources to other stimuli. Though distinct, the two are conceptualized on one continuum in this four-dimensional model such that rapid interruption is perceived as co-occurrence. The more task co-occurrence and/or task-interruption involved, the more intense the media multitasking. As prior research shows, longer duration of task co-occurrence and more frequent task interruption require more perceptual and cognitive resources (Lang & Chrzan, 2015; Salvucci et al., 2009; Wang et al., 2015; Yeykelis et al., 2014).

Task difficulty involves the perceived degree of challenge or demand imposed by media and physical tasks. Difficulty of the tasks has been previously theorized to involve the information flow, behavior inputs, novelty, skill required, and duration required for the processing of the information (Lang & Chrzan, 2015; Wang et al., 2015). It is far more difficult to play a multi-player shooter video game in the middle of battle while completing or switching in between to calculus problems than it is to re-watch an episode from a sitcom for the 6th time while organizing files on one's computer. There are of course other factors that may influence task difficulty, such as individual capacity, perceptions, and context. For instance, for each category of media stimuli such as texting messaging or watching a movie, the difficulty or resources required can vary because the content was emotionally heavy or the context was socially uncomfortable. Because difficult tasks require more resources, the greater the task difficulty involved in media multitasking, the more intense it becomes.

Task intentionality is the perceived degree of purpose, motivation, and value of engaging in media and physical tasks. Media multitasking has largely been problematized as an unintentional behavior caused by a deficiency in control (Nass et al., 2009), and at best considered a potential form of mind-wandering (Ralph et al., 2013). Yet, the expected, intentional, managed, and purposeful engagement in multiple tasks including media is a crucial yet understudied dimension of media multitasking experience. For example, consider the process of watching a show by oneself in a given location, but texting simultaneously about the show with a friend who is watching from another location. Such intentionality can reduce the perceptual load and indirectly reduce cognitive load while engaging in task co-occurrence or interruption. Indeed, Kononova et al. (2016) concluded that memory of a task is better when one intentionally chooses to switch between tasks. However, intentionality may interact with task difficulty such that even for easy tasks, intentionally multitasking may require greater cognitive load, because intentionality itself requires effortful thinking.

Relevance is the perceived shared value or purpose amongst tasks as well as the degree to which the tasks complement or enhance one's experience of engaging in one or the other task. Relevance often varies more subjectively in leisure or unstructured activities and times. Scrolling through social media and journaling may appear unrelated, but could be related if social media prompted thoughts to write about or if the journaling was about social media. Relevance of tasks to each other reduces competition for cognitive resources and allows for more information synthesis or sensory integration (Wang et al., 2015; Yeykelis et al., 2014). Thus, the greater the perceived relevance the less intense the media multitasking.

(Artificially) dichotomizing each of these four dimensions creates 16 possible combinations, representing higher or lower levels of media multitasking *intensity*. For instance, as co-occurrence/interruption and difficulty are high, and intentionality and relevance are low, intensity may be highest. *Higher* media multitasking intensity involves greater difficulty of information processing and/or sensory demand by increasing the volume and variety of input(s) that cannot become integrated (i.e., are irrelevant to the main task) and thus compete for processing resources.

Individual Influences on, and a Central Outcome of, Media Multitasking Intensity

This section reviews two predominant individual differences theorized to contribute to variation in the behavioral and cognitive dimensions of multitasking in general and media multitasking in particular: executive functioning and self-regulation. These two individual differences will then be related to cognitive and personality development and thus differences in media multitasking intensity and outcomes between adolescents and their parents. This section also highlights the relationship between media multitasking intensity and a central outcome in multitasking research: general stress.

Executive Functioning

Executive functioning refers to attention, working memory, and inhibitory capacities that are involved in goal-directed cognition and behavior. Nigg (2017) summarized the definitions of executive functioning as functions that support rule-following or top-down processes. This includes selective attention, shifting attention (task switching), filtering information, response inhibition, and sustained attention. These capacities allow people to anticipate, plan for, and solve problems (Diamond, 2013), and thus have been theorized as influencing media multitasking.

Executive functioning has been the predominant individual difference related to media multitasking since the seminal work of Ophir et al. (2009) found a diminished filtering of irrelevant information occurred amongst the most frequent media multitaskers, termed the breadth-bias. The multitude of studies that aimed to replicate these findings have failed to produce consistent results (Chein et al., 2017; Wiradhany & Nieuwenstein, 2017). Within the existing literature, some studies have associated heavy media multitaskers with advanced executive functioning (Alzahabi & Becker, 2013; Cordoso-Leite et al., 2016; Kononova et al., 2016; Minear et al., 2013), while others found it was associated with diminished executive functioning (Baumgartner et al., 2014; Jeong & Hwang, 2016; Ophir et al., 2009; Uncapher et al., 2016). In their meta-analysis, Wiradhany and Nieuwenstein (2017) conclude that when existing findings are adjusted for sample size, the estimated association between executive functioning and media multitasking across studies neared zero. The methodological explanations for these inconsistencies include error in self-report of media task engagement over a week and difficulty in comprehension of concurrent engagement in media tasks. However, we suggest that the unobserved heterogeneity in media multitasking *intensity* within these examinations may

explain the lack of consistent relationship. In other words, these inconsistent findings are explained by the relationship between *co-occurring or interrupting tasks, task difficulty, task intentionality, and task relevancy.*

The unidimensional models of media multitasking that focused on frequency assumed that all media task combinations are equivalently weighted. However, this overlooks cognitive and behavioral variation in the ways in which tasks co-occur or interfere with one another, differ in perceived as well as actual difficulty, intentionality, and relevance. Thus it fails to consider the differences in the cognitive and perceptual effort they require. It is predicted that poorer executive functioning, or less attentional and working memory capacity, selective attention, behavioral inhibition, and filtering of irrelevant information, would increase the likelihood of engaging in tasks that overlap and interfere with one another or more shifts between tasks. Those with poorer executive functioning are also more likely to engage in difficult co-occurring or interfering tasks, due to their inability to control their attention and inhibit behavior. They may even be more likely to perceive more tasks as difficult because of their lower attentional and working-memory capacities. Both the increased difficulty and co-occurrence/interruption amongst tasks are likely to co-occur with intentionality because it is an outcome of a lack of attentional and behavioral control. Finally, executive functioning is necessary for identifying and filtering out irrelevant information. Thus, it is predicted that those with poorer executive functioning will report engaging in tasks with less relevancy. In summary, deficient executive functioning is likely to predict higher media multitasking intensity demonstrated by increased task occurrence and interruption and task difficulty, but decreased task intentionality and relevancy.

Self-Regulation

Though only a few studies have considered the role of self-regulation in media multitasking (Reinecke et al., 2018; Xu et al., 2016; Zhang, 2015), self-regulation has been associated with increased likelihood to engage in healthy behaviors (e.g., eating healthy) and to avoid unhealthy behaviors (e.g., binge drinking) (Hagger et al., 2009; John & Gross, 2004). Resilience (i.e., the ability to overcome stress) to stressors, either psychological or physiologically, has been theorized as an outcome of human capacity to allocate internal and external resources in order to adapt to one's environment (Afifi et al., 2016; Eisenberg, 2017; Folkman et al., 1986; Floyd et al., 2010; LaRose, 2015; Lang, 2013; Lavee et al., 1985). Schilab (2017) thus argues that a media-saturated environment requires self-regulation to adapt to its best uses. The ability to allocate resources toward the goal of adaptation includes the capacity to regulate one's cognition, emotion, and behavior.

Self-regulation, thus, is defined as the ongoing intrinsic process of managing mental and physiological states via altering cognitive, emotional, and behavioral responses to achieve personal goals (Nigg, 2017). It includes deliberate or top-down processes, bottom-up or reactive/automatized processes, and the interplay between the two, that are used to monitor and adjust one's behavior in order to achieve explicit or implicit goals or goal states (Baumeister & Vohs, 2017; Nigg, 2017). Thus, there are three components of self-regulation: the ability to monitor behavior, the cognition about and emotional appraisal of behavior, and the following adjustment or adaptation of behavior (Baumeister & Vohs, 2017; LaRose, 2010, 2015; Nigg, 2017). All three can occur both via conscious thought and automatic processes, which function together and react to one another to drive goal-oriented behavior. Self-regulation is a capacity that depends on executive functioning capacities. Yet, it is distinguished from executive

functioning because it includes bottom-up processes or automatic reactions to stimuli and it refers to applying attentional and working memory capacities to the self (Nigg, 2017).

Conscious and unconscious forms of self-regulation may both be limited. The top-down aspects of self-regulation or effortful self-monitoring, evaluation, and behavioral control capacities are especially limited resources that require energy and glucose expenditure (Baumeister & Vohs, 2017; Lang, 2009). Due to the limited resources of energy and thus executive functions such as attention, working-memory, and behavioral inhibition (Barkley, 2012), it is possible to experience depletion after instances of self-regulation. According to ego-depletion models, as self-regulatory resources are expended more frequently, people are more likely to experience failures of self-regulation. People are motivated to allocate self-regulatory resources to maintain their energy and conserve resources and thus to strategically use their attentional resources with media or reframe their media use (Baumeister & Vohs, 2017; Gross, 2014; Lang, 2009; Wang et al., 2015).

Previous research, though sparse, has supported the relationship between media multitasking and self-regulation. Xu et al. (2016) revealed that self-control, often defined as a stable trait-like capacity for self-regulation, not only predicts the frequency of media multitasking, but also the types of media multitasking in which people tend to engage. Those with lower self-control reported engaging in more cognitively demanding forms of media multitasking. In addition to this self-report evidence, Szumowska et al. (2018) conducted an experiment where participants were asked to multitask in the lab. Only heavy media multitaskers who had low self-regulation capacities a) task-switched more often and b) performed worse on their tasks. These findings extend to the relationship between self-regulatory capacities and media multitasking in consequential contexts such as lectures or within classrooms (Rosen et al., 2011; Zhang, 2015). Schutten et al.'s (2017) results echoed these results. Their survey showed that frequent media multitasking was associated with less reported self-control and greater impulsivity or less task intentionality. These studies in conjunction suggest that deficient self-regulation would predict higher degrees of *co-occurrence and interferences between tasks* and *task difficulty*, but lower degrees of *intentional allocation* and *relevance*. Therefore, it is hypothesized that insufficiencies in self-regulation will also predict more frequent engagement in intense media multitasking. Due to the specificity of self-regulation, its role in allowing people to master their media uses, and to learn from adversity and adjust (Rice et al., 2018), it is likely that self-regulation will be a stronger predictor of media multitasking than will executive functioning.

General Stress

The propensity to media multitask has been related to diminished relational satisfaction between partners (McDaniel, 2015; Wajcman et al., 2008), lower relational satisfaction between parents and children (McDaniel & Radesky, 2017; Radesky et al., 2016), diminished sleep, and increased unhealthy eating. In these studies, people can experience conflict, loneliness, and frustration due to either their own or their loved ones' media multitasking habits. In a few studies, increased media multitasking has also been associated with diminished health such as experiences of digital information overload (Reinecke et al., 2017), social stress (Pea et al., 2012; Xu et al., 2016), and even depression and anxiety (Becker et al., 2013; Rosen et al. Cheever, 2013). Some of this scholarship has revealed that the context in which one media multitasks (McDaniel & Radesky, 2017; for example, frequently engaging in media tasks at dinner) and the types of media used while media multitasking (Lang & Chrzan, 2015; Lau, 2017; Wang et al., 2015; for example, irrelevant and difficult task combinations) predict these negative outcomes. These contexts, in summary, are those in which the concurrence and interference between media

tasks and physical tasks are *irrelevan*t and *difficult* (i.e., answering a work-email when on a romantic date) or *irrelevant* and *less intentional* (i.e., watching TV before, and scrolling through Instagram while, aiming to sleep). Media multitasking intensity increases as tasks co-occur and interrupt one another, are more difficult, less intentional, and less relevant, increasing goal conflicts and requiring more perceptual and cognitive resources. Thus, high media multitasking intensity will likely lead to demand-resource ratios in which demand far exceeds resources, resulting in fatigue, frustration, and stress. Those who engage in *high media multitasking intensity* (greater task co-occurrence and interruption and task difficulty, and less task intentionality and less task relevancy) are likely to perceive more general stress (Freytag et al., 2021; Lee, Sonm & Kim, 2015; Misra & Stokols, 2012; Reinecke et al., 2017; Wang et al., 2015). Yet, as people seek and gain resources, they can cope such that they engage in less intense media multitasking they can not only feel less stress but also more enjoyment.

Application Example: Family and Adolescents

Media Multitasking in the Family

The family system provides a unique context in which to examine influences on, models of, and outcomes from, media multitasking. As devices, sites and apps that connect people to media have become more ubiquitous, parents and children have also increasingly reported that the uses of these technologies have become a source of anxiety and conflicts within the home (McDaniel & Radesky, 2017; Warren, 2016). Parents or primary caregivers who are digital immigrants (i.e., they are still adopting and assimilating to a digital environment) are posed with a difficult task of successfully mastering technology and socializing children who are digital natives (i.e., immersed in a digital environment and potentially more assimilated), in a media-saturated world. Thus, parents and children may experience the tensions of media mastery (Rice et al., 2018), intra- and interpersonally generating stress within the family system (Afifi et al., 2018). To further complicate the issue, scholarship in the area of child development and media theorizes that the best uses and the most harmful impacts of technology are nuanced. They fluctuate depending on family structure, parental efficacy and attitudes, and socioeconomic background (Jennings, 2017; Nathanson, 2015; Slater et al., 2015).

Media Multitasking by Adolescents

Self-regulation capacities develop across the lifespan. While adolescents begin to develop their self-regulatory capacities, their developmental stage poses new challenges. Adolescents' insufficient self-regulatory capacities are juxtaposed with their need for autonomy. Adolescents are also generally motivated to discover their identity or role within their social environment. Adolescents undergo vital changes, including the process of obtaining autonomy from their parents or primary caregivers and developing their own identity. They also experience immature impulse control, greater emotional intensity, salience of their social networks, and unfamiliarity with self-monitoring and perspective-taking (Steinberg et al., 2017).

Given that today's adolescents have perpetual access to social networks and social information, these developmental characteristics of adolescence and their inherent preoccupation with their developing and changing social relationships and group memberships (especially within their online social media networks) may explain why teens more frequently engage in media multitasking and experience more media-related stress than do other ages (Afifi et al., 2018; Baumgartner & Sumter, 2017; Brasel & Gips, 2011; Judd & Kennedy, 2011; Reinecke et al., 2017; Voorveld & van der Goot, 2013). Media multitasking is perceived as a necessary skill and even vital centerpiece of socioemotional development especially amongst adolescents (boyd, 2014; Rice et al., 2018). Yet concerns about the effects of media device use on adolescents

appear to be warranted. Media multitasking is the most prevalent among, and harmful for, youth (Pea et al., 2012; Reinecke et al., 2017).

Their preoccupation with their peers and fear of missing out (Blackwell et al., 2017; Reinecke et al., 2017) may motivate internal interruptions or self-interruptions to their completion of homework, family dinners, and social events (Turkle, 2011). Additionally, members of their increasing social networks (boyd, 2014), may be equally likely to have lower self-regulatory capacities. Their behaviors could serve as external interruptions and motivations for media multitasking with demanding tasks. Due to their growing peer networks, adolescents can experience significant demands on their emotional regulation capacities and information processing capacities that are still underdeveloped (Carrier et al., 2015; Konijn et al., 2015). Thus, the levels of and interactions between adolescents' self-regulation capacities, developmental stage, and the media-saturated environment increase their likelihood of engaging in more intense media multitasking and experiencing the most detrimental effects.

Scholarship on adolescents' well-being and media use provides some evidence about how their motivations for media use can lead to problematic media multitasking (see Table 1). For example, Reinecke and colleagues' (2017) survey of media multitasking across the lifespan reports that youth (14-25) engage in more frequent media multitasking and experience more digital stress than adults of any age group. The respondents reported engaging in Internet multitasking more often due to social pressure and fears of missing out, and feeling more overwhelmed by technology than did adults. Afifi et al. (2017) similarly find that adolescents demonstrate more physiological and psychological stress due to their technology use than do their parents. Corresponding with previous research (Lee et al., 2015; Steinfield et al., 2008), this stress was not associated with the frequency of their social media use but rather with the size of their social networks on social media. This suggests, as noted above, that, along with lower self-regulation, their extended social network and social pressures may be a fundamental motivator for harmful media multitasking. Therefore, the relationship between self-regulation and media multitasking *intensity* is likely to be moderated by whether one is an adolescent (Valkenburg & Peter, 2013), such that it is stronger for adolescents than for adults (parents).

Some Methodological Implications for Studying the Theory of Media Multitasking Intensity

Self-Report

Because the four dimensions of media multitasking *intensity* depend on perceptions of task dimensions, it is recommended that such studies employ self-report methods. However, there are two critical challenges to accurate self-report measurement. The media-saturated environment has made media experiences mundane (Potter, 2018), and the cultural shifts in the definitions of media more colloquial, collectively posing challenges to non-experts' abilities to report on their media tasks. Moreover, self-report requires self-awareness, working-memory, and attention, all of which have been predicted in the past to relate to media multitasking frequency and may have relationships with dimensions of intensity such as task intentionality and relevance.

Contexts

Media multitasking *intensity* is a subjective experience and an outcome of a person-by-context interaction. As Lang and Chrzan (2015) concluded from their review, different types of multitasking typically lead to at least somewhat different results. Previous research has demonstrated that media multitasking can be motivated by context because people aim to conserve their cognitive resources when they perceive them as limited, and aim to expend more

resources when they experience fewer demands in their environment (Csikszentmihalyi, 2000; Lang & Chrzan, 2015; Ralph & Smilek, 2018; Wang et al., 2015; Yeykelis et al., 2014). More specifically the four dimensions of media multitasking intensity are likely to vary across different contexts (temporal, social). This creates a theoretical and epistemological concern. In general, then, relevant context should be customized for the purpose of the research and the nature of the sample, so temporal and social contexts are not included in the construct map (Figure 3).

Concerning *temporal context*, existing measures such as the MMI (Ophir et al., 2009) have thus far examined media multitasking behaviors (e.g., dual tasking with multiple media) in a typical or most recent weeks. This epistemological approach has become criticized for creating noisy data and lacking validity due to limitations to recall (Chein et al., 2017). By relying on typical media use, these measures are also imbued with the assumption that media multitasking behaviors are trait-like and stable (Ophir et al., 2009). Because the analysis of media multitasking intensity focuses on specific contexts, we therefore recommend constraining the time on which the participant reflects, to assess their most recent engagement in tasks within a specific recent time period. Because media multitasking is a variable experience, and contexts change, we recommend the use of several, longitudinal ecological momentary assessments (Hedstrom & Irwin, 2017; Hektner et al., 2007) (whether on paper, online, or via a mobile device app). Administering the questionnaire only cross-sectionally would not provide enough information to make some claims about an individuals' media multitasking intensity. Thus, associated research would investigate whether the four-dimensional model of media multitasking *intensity* theorized here fits the observations obtained from ecological momentary assessments of behavior and cognition involving non-media and media tasks in respective recent, specific, and short-duration periods, and in relevant contexts. Longitudinal designs could also identify the portion of variance explained by the individual as evidence of stability of the claims, and that explained by contexts. Thus, longitudinal or repeated observations of an individual's media multitasking intensity in a specific context may allow for early investigations to secure some evidence of validity for media multitasking intensity as an attribute of an individual though within given (or common) contexts. For instance, using a measure of media multitasking intensity within the context of bed-time longitudinally can allow for generalizations about people who are *bed-time* media multitaskers. This may not generalize to morning media multitasking behaviors.

A valid measure of media multitasking intensity should include information about the *social context* as well. Lang and Chrzan (2015) do note the need to include non-cognitive or emotional goals or motivations for media multitasking. For example, enjoyment of a task (instead of effective or efficient task performance) may be a desired motivation and outcome. Indeed, the media combinations observed within the MMI primarily include those that are used for leisure (such as music and television, instant messaging and talking on a phone call, or surfing the internet and listening to podcasts). However, it includes few potential combinations with work- or school-related contexts (as software like Microsoft Word, Excel, or Adobe PDF are all categorized as computer-based applications). Therefore, that measure is not equipped to observe work-relevant media multitasking, and thus represents less relevancy between media in this context. Thus one general social context that represents not only different levels of consequence but also different kinds of motivations or enjoyment would be whether the goal activity is work-related or leisure-related. For example, either a measure of extent of work and leisure, or experimental conditions of recalling a work- or a leisure-related context, may be

included in studies of media multitasking intensity. Media multitasking intensity during leisure contexts might really increase enjoyment or relaxation; during work, it might play a role in increasing motivation.

In addition, context could vary in *difficulty* of the media tasks, which is already included in the construct map (Figure 3) and thus the measurement of media multitasking. However, the dimension of difficulty may alternatively be represented through recalled conditions. Thus a quasi-experiment may prompt the respondent to recall a recent goal in any (or, randomly presented, all) of the quadrants of the work-leisure and easy-difficult contexts. For example, greater co-occurrence and interruption, and lesser task relevancy, should be expected in easy leisure contexts, while the opposite are likely in difficult working contexts. An easy leisure context should be related to the perception of higher resources-to-demand ratio.

Conclusion

The theory of *media multitasking intensity* provides clarity and direction to a convoluted and currently fragmented, yet important field of study, by interweaving general theories from psychology and media into a field-specific theory. It provides a causal model via a set of assumptions, a predicted set of relationships between constructs, and a construct map that allows scholars to capture greater and more meaningfully interpret variation in media multitasking. It explains existing inconsistencies in the literature as well as provides solutions to measurement-based challenges within the field. While the current literature mainly problematizes media multitasking, this theory provides the vocabulary for identifying beneficial media multitasking, which improves motivation, enjoyment, and sensory integration. The theory implies that media multitasking's relationship with well-being is nuanced; it is not a destructive behavior but can signal poor coping with conflicting goals and stimuli to process. Thus, societal implications include creating resources to improve coping especially among vulnerable populations such that they experience less intense media multitasking, more satisfaction, and greater growth.

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Table 1
Selected Negative Implications of Media Multitasking

Academic: Cognition
• Heavy media multitasking university students performed significantly worse than low media multitaskers on tasks involving task switching and suppressing of irrelevant distractors, i.e., cognitive control capacities (Ophir et al., 2009) • Auditory and visual channels of information processes are limited, so essential processing is taxed during multitasking, reducing deeper learning, which can impede academic performance (Junco & Cotten, 2012) • Those with their phones nearby performed worse on tests of cognitive capacity (working memory and fluid intelligence) than those with their phones in another room (Ward et al., 2017) • Media multitasking is associated with attentional failures in addition to a propensity for mind wandering or engrossment in "off-task" thoughts, and more attention-related errors in their daily lives (Ralph et al., 2014) • Participants report that media multitasking is related to less effective and efficient work as well as express experiencing constant distractions (Wang et al., 2012; Zhang & Zhang, 2012)
Academic: Performance
• Checking Facebook and text messaging whether in the classroom or while studying were negatively associated with GPA (Junco & Cotten, 2011a, 2012) • Academic use of social media, whether inside or outside the classroom, did not compromise GPA, whereas playing video games or multitasking with social media during schoolwork did show a negative relation with GPA (Lau, 2017) • GPA declined the more freshman, sophomores, and juniors used Facebook while doing schoolwork (Junco, 2015) • Other effects of multitasking responsible for poorer academic outcomes include anxiety and fear of missing out (Lepp et al., 2014) • negative effects of task switching on productivity (Rosen et al., 2013) • time displacement in total hours studied (Kirschner & Karpinski, 2010) • Students do not learn as well in class environments that allow media multitasking with platforms like Facebook or MSN Messenger (Wood et al., 2012) • When students media multitask with texting or social media in the classroom, their academic performance suffers (Junco & Cotten, 2011a, 2012) • Multitasking in the classroom with social networking sites and instant messaging decreases productivity and efficiency in the classroom (Bowman et al., 2010; Fox et al., 2009; Jacobsen & Forste, 2011). • Engaging in distractive media multitasking through laptops is related to lower academic performance (Fried, 2008; Kraushaar & Novak, 2010; Wood et al., 2012) • Despite their perceptions that they are better at multitasking, heavy media multitaskers do worse (Ophir et al., 2009)
Academic: Reading & Studying
• Both efficiency and comprehension on a reading task were compromised when an assignment in the classroom was interrupted (Carrillo & Subrahmanyam, 2014). • A group conducting a reading assignment that was interrupted with text messages took longer to read, even after the interruption time was taken out (Carrillo & Subrahmanyam, 2014) • Students in one study had 15 minutes of study time, but interruptions from task switching led them to only use 9 minutes of it (Rosen et al., 2013)

• Students could not maintain studying for more than three to four minutes without switching tasks, even when the material was very important for their studies (Rosen et al., 2013)
Health
• Injuries and deaths from texting while driving (and walking) (Hyman et al., 2010; Nemme & White, 2010) • Media multitasking with electronic screens can lead to sleep problems and their negative outcomes (Cain & Gradisar, 2009; van der Schurr et al., 2018) • Media multitasking habituates one toward short-term gratification. Such repeated reinforcement will weaken the long-term gratification neural system and strengthen the short-term neural system. Such processes are also exploited in video game design as well as other media to create "compulsion loops" that work through short-term reinforcement via hits of dopamine (Han et al., 2011; Howard-Jones & Jay, 2016) • Digital information overload (Reinecke et al., 2016) • Social stress (Pea et al., 2012; Xu et al., 2016) • Depression and anxiety (Becker et al., 2013; Rosen et al., 2013)
Interpersonal
• Face-to-face relationships can be compromised by media multitasking at family dinners, outings with friends, or work activities (Turkle, 2015) • The mere presence of a phone negatively affects empathy, closeness, and conversation quality in dyads (Misra et al., 2016; Przybylski & Weinstein, 2012) • Diminished relational satisfaction between partners (McDaniel, 2015; Wajcman et al., 2008) • Lower relational satisfaction between parents and children (McDaniel & Radesky, 2017; Radesky et al., 2016) • Conflict, loneliness, and frustration due to either their own or their loved ones' media multitasking habits (McDaniel & Radesky, 2017; Radesky et al., 2016)

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Figure 1

Relationships among Media Multitasking Intensity Dimensions and Perceptual and Cognitive Load