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Interdependencies related to Attention Restoration for Mental Fatigue: A scoping review

Nacherree Kanthong[1*], Heng Zhang[1]

[1*] Department of Architecture, National Cheng Kung University, Tainan City, Taiwan
* Corresponding Author

n78107022@gs.ncku.edu.tw, changlin@mail.ncku.edu.tw
Tel: +886 090 899 8614

Abstract
This paper investigates and gathers data on the causal constraint rehabilitation of mental fatigue linked with attention restoration (ART) components that correlate with the scale of perceived setting interdependencies (PSI) to identify the relationship between the component of ART and the scale of PSI that affect mental fatigue recovery by using scoping review, searching keywords from international literature from 1979 to 2022 in a relevant database and snowballing method in the references list to get a recent paper that is related. Relationships were conceptualized using perceived setting interdependencies (PSI) indicators that identified the relationship between attention restoration and mental fatigue.

Keywords: Behavior setting; Interdependence; Mental fatigue; Attention Restoration

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1.0 Introduction

There are several adverse outcomes associated with mental fatigue. For example, mentally exhausted individuals are likely to require more time for task planning and less flexibility in problem-solving. Both are general restrictions on work performance (Van der Linden et al., 2003). various empirical studies have demonstrated that spending time in rest areas, particularly the natural environment, promotes mental fatigue recovery.

According to the attention restoration theory (ART), The cognitive capacity of humans for directed attention is limited. This capability will deteriorate if sustained concentration over an extended time period is required (Kaplan & Berman, 2010). Once the psychological resources for directed attention are expended, mental exhaustion will ensue. In addition, the theory assumes that restoring the psychological resources for directed attention is a vital element of preserving health and well-being (Kaplan, 1995). Moreover, compared to other environments, those that actively encourage us to let our minds wander and do not force us to concentrate on things that require our attention provide a greater level of restoration (Berman et al., 2012). The perceptual understanding of the dimensions "fascination," "being away," "extent," and "compatibility" helps to determine if the environment makes us conducive to attention.

Moreover, it may contribute to the restorative process(Kaplan & Kaplan, 1989). An environment with a fascination element to attract attention, Being away to support the restoration of reduced cognitive resources for directed attention, the extent of the opportunity to engage with the surrounding environment, and compatibility between the environment and what people want to do. Thereby contributing

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to health and well-being. These environments are typically called restorative environments (von Lindern, 2017). Fascination and extent result partly from the perception of physical environments, whereas explicitly being away involved not only being physically absent but also psychologically removed from the responsibilities and stress of daily life (Kaplan et al., 1998). However, we have more difficulty achieving psychological separation from work-related obligations, personal difficulties, and daily hassles (von Lindern, 2017).

This theory and the definitions of fascination, being away, extent, and compatibility imply that restorative qualities are not inherent to any particular environment but rather that the amount of actual restoration depends on human-human and environment-human interactions. The previous study showed that varying levels of individual involvement affect psychological restoration from exposure to the natural environment. (Duvall, 2011; Lin et al., 2014; Nisbet et al., 2019).

Behavior settings (BS) are aspects of person-environment interactions that promote or inhibit restorative processes (von Lindern, 2017). The behavior setting theory incorporates environments' social, psychological, and physical aspects. This combines complementary relationships with social roles and specific behavior (Wicker, 1992). The psychological outcomes of daily exposure to the natural environment may be constrained by the transaction properties leading to restoration. Previous studies have shown that urban green spaces have negative transaction properties. Restoration includes city noise, traffic, and poor design(Taylor et al., 2020). each BS has attributes that inhibit or encourage specific behavior (Schoggen, 1989).

Components within BS are interdependence between each other. Each component has a different degree of interdependence depending on many factors. It occurs in many outcomes. The scale to measure perceived setting interdependencies (PSI) has 7 scales: person, leadership, cognition, object, behavior, location, and time. From the previous, the interdependencies and the ART component are related (von Lindern, 2017). This raises the question of how the scale of PSI relates to ART components. that affect mental fatigue recovery.

2.0 Literature Review

2.1 Constraint mental fatigue

The natural environment is known to contribute to the relief of mental fatigue, The connection with nature is the result of an individual's engagement in an experience of interaction with nature, a busy and noisy urban environment, individual attitude, work stress, and other factors that may constrain an individual's access to the natural environment (Macaulay et al., 2022). This situation, described in behavior setting theory, is caused by how a person's cognitive process occurs. Interdependence between the two settings inhibited the process of mental fatigue recovery. Von Lindern (2017) found that when participants perceived higher interdependencies between cognitively demanding and leisure-time contexts, their experience of being away and self-reported health-related outcomes were diminished. The scale to measure perceived setting interdependencies (PSI) (Schoggen, 1989) affects, promotes, or inhibits restorative processes at different levels. Previous research found that interdependence correlates with the ART component. There is also a gap in the study on how the scale of PSI correlates with the ART component.

3.0 Methodology

3.1 Study selection: Eligibility Criteria

This study searched keywords from 120 pieces of international literature from 1979 to 2022 in a relevant database such as SCOPUS, Web of Science, or PubMed. It used the snowballing method in the references list to get a recent paper related. 15 of the 120 records evaluated by the researcher for inclusion in the qualitative synthesis were selected to classify the effect report. Perceive setting interdependencies (PSI) indicators were used to identify the relationship between attention restoration and mental fatigue.

3.2 Study selection: Study selection organization diagram

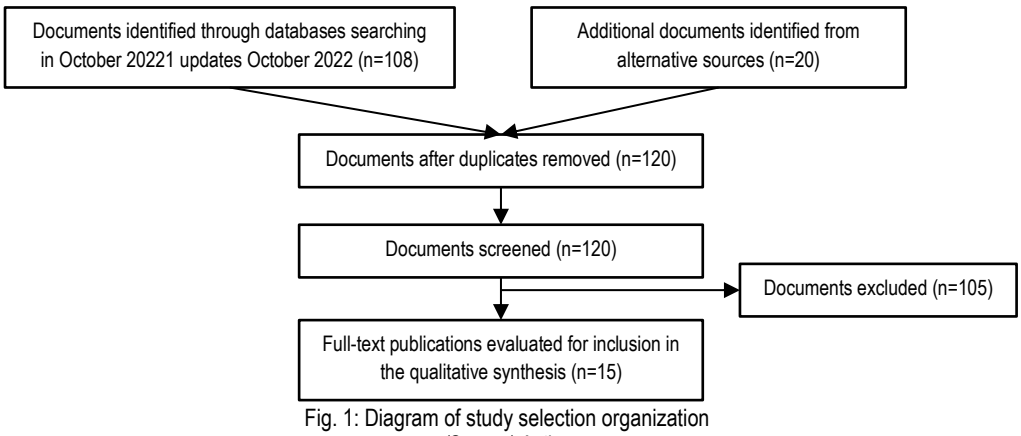

Fig. 1: Diagram of study selection organization
(Source:) Author

4.0 Findings

The results are separated into two parts. The findings from the review of the relevant literature are presented first, followed by qualitative synthesis data.

4.1 The Findings from the Review of the Related Literature

The initial search of the available literature was conducted in October 2021. The most recent revision was made in October 2022. Fig.1 presents a flow chart that illustrates the overall search process. In October 2021, after taking out the duplicates, we were left with 120 citations, however, after analysing the titles and abstracts, we decided to disregard 8 articles. For this assessment, a total of 12 full-text reports were chosen. In October 2022, a search via electronic databases was identified to locate reports published between October 2021 and October 2022. The search turned up five new recordings, each of which was analysed in depth, and two of them were chosen.

4.2 Characteristics of Studies Included

A summary of the study It was discovered that most studies were focused on attention restoration theory, both proven and experimental in a variety of settings, along with factors such as mood-related outcomes, job satisfaction, cognitive appraisals, etc., that the study about the interdependencies of behavior setting related to attention restoration has not been well studied. Previous studies focused on interdependencies between human-human (Gerpott et al., 2018).

Most studies were conducted in university settings, laboratories, public parks, accommodations, hospitals, etc, primarily used to contrast mental fatigue relief with the sensation of living, seeing, hearing, walking, etc., in a natural environment. In comparison to metropolitan surroundings, outcome assessments are subdivided into measures of attention restoration via the perceived restorative scale, capacity to direct attention, mood measure, and so on—physical results, including a battery of physiological measurements.

There is research in the scope of studying and experimenting with the environment with overall and constituent attention restoration. This section will be eliminated. Since we wanted to study issues related to transaction procedures that promote or constrain attention restoration, studies of human-human behavior settings were excluded, focusing on the part of environment-human. Characteristics of the full paper read for the synthesis in the next step is a study that correlates Interdependencies with attention restoration found two papers, Two papers on the interdependence of behavior setting, studies related to constraint attention restoration within the scope of environment-human have five studies and six studies on indicators promoting attention restoration.

Table 1. A summary of the key characteristics of the studies considered for inclusion.

Author(s), year	Location	Population	Methodology	Outcome measures
1. Hartig, Catalano, et al. (2007)	Sweden	Number of prescriptions N06AB	Arima modeling, equation	antidepressant, temperature
2. Hartig, Kylin, et al. (2007)	Sweden (online)	N: 101 Female: 46 x̄: 45.24 yrs.	Survey questionnaire	overlap work& non-work life, spatial arrangement, telework& effective restoration
3. Hansmann et al. (2007)	Urban forest, city park, Switzerland	N: 164 Female: 93 49.4% > 50 yrs.	Field survey	Relationship between activities and restorative effects
4. Nordh et al. (2009)	Pocket Park, Scandinavian cities	72 parks	Survey	Being away, fascination, preference, perceived likelihood of restoration
5. Popov and Chompalov (2012)	-	-	Breadth and scope review	breadth and scope, internal consistency, intertheory support, and empirical support
6. Gatersleben and Andrews (2013)	Laboratory, United Kingdom	N:269, 17 Female: 198, 10 x̄: 22.48 yrs.	Survey, experimental	perceived restorative, danger, fear
7. von Lindern et al. (2013)	Sweden (online)	N: 1,678 Female: 822 x̄: 46 yrs.	Cross-sectional survey (questionnaire, interview)	profession, reported restoration, Being away, Familiarity, Fascination, Forest visitation, Disturbances
8. Van den Berg et al. (2014)	Laboratory, Netherlands	N: 102 Female: 54 x̄: 22.2 yrs.	Experimental	Mood, restorative state
9. von Lindern (2015)	Wilderness Park, Switzerland	N: 115 Female: 68 x̄: 44 yrs.	Visitor survey questionnaire	self-reported mood-related outcomes, recovery experience questionnaire, PRS, PSI, perceived stress scale
10. von Lindern et al. (2017)	-	-	Literature review	restoration perspective, overview theoretical, restorative environments, restorative environments for further research and interventions
11. von Lindern (2017)	Switzerland (online)	N: 726 Female: 479 x̄: 45 yrs.	Survey questionnaire	self-reported, PSI, being away, restorative outcomes experienced
12. Majnouni-Toutakhane (2018)	Park, Iran	N: 400	Survey questionnaire	variables of citizens' social behavior, factor preference
13. Ibrahim et al. (2019)	Open space, Malaysia	N: 861	Survey questionnaire	human-nature interaction, human-human interaction
14. Macaulay et al. (2022)	-	-	Literature review	contact, beauty, compassion, emotion, meaning

15. Rapuano et al. (2022)	Italy	N: 80 Female: 40 $\bar{x}$: 30.5 yrs.	Survey questionnaire	Calm, energetic, happy, nervous, tired, sad

(Source:) Author

**PRS: Perceived Restorativeness Scale, PSI: Perceived Setting Interdependencies*

5.0 Discussion

5.1 Mental fatigue under the aspect of Attention restoration theory (ART)

The Attention Restoration Theory (ART) (Kaplan, 1995) has driven research on the restorative potential of various green space options. ART has concentrated on human-environment interaction components. That promotes attentional restoration from mental fatigue or the exhaustion of cognitive resources. ART identifies four essential elements that have formed the primary paradigm for comprehending restorative environment experiences.

Understanding restorative environment experiences: Fascination. People find numerous processes in nature fascinating. Many of the natural environment's attractions qualify as "soft" fascinations: sunsets, clouds, snow patterns, and wind-driven leaf motion are all examples of soft fascinations. Attending to these patterns is effortless, and they afford adequate time for other considerations. Being away the psychological distance from the tasks and routines for which the directed attention capacity is used. Opportunity for exploration and engagement with the surrounding environment. The environment should be physically different, which allows individuals to engage mentally in this different environment and not interfere with daily activities such as reply work emails.

Third, the extent points out the degree of order or coherence and the opportunity for exploration and engagement with the surrounding environment. Engage with the surrounding environment through awareness. Perceptual sensitivity is one of the areas that increase awareness of the surroundings. (Macaulay et al., 2022). Some people may have personal factors that cause sensitivity to a decrease in the perception of the surrounding environment. Increased sensitivity may be enhanced by environmental attractions such as flowers' beauty, birds' sounds, etc. Fourth, compatibility occurs when the environment matches the activity that each person tries to do. Each goal must be consistent with the needs of the environment. The environment must provide people with the information necessary to achieve their objectives. However, it might be a constraint (Macaulay et al., 2022) explains that limited experience can influence the ability to respond to individual needs. Although these elements are present in both built and natural environments, ART claims that combining the four components is most common in natural settings, giving natural settings a more substantial restorative potential. There are also factors that can affect restorative quality, for example, fascination with the environment and the disruption of being away from demanding situations.

In a scoping review, past research on the environmental effect has found empirical evidence that the natural environment causes attention restoration to reduce mental fatigue. It also found that natural environments with different components had different effects on relaxing people's emotions (Rapuano et al., 2022).

The perceived Restorativeness Scale (Hartig et al., 1991) is the most often used measure for assessing the restorativeness of space. Most studies use the indicator of component analyzed as an overview of the attention restoration result, along with other dimensions. However, it also found that some studies have focused on the attention restoration component, along with other dimensions. There are few studies in this section, which is still a gap study.

5.2 Interdependence of behavior setting theory effect on mental fatigue

Behavior setting theory (BST) integrates the social, psychological, and physical components of environments with specific behavior to produce behavior settings (BS) (von Lindern, 2017). BS is a physical environment with functional and organizational objectives. In BS, human behavior depends on the environment's physical dimension and collective behavior (Guéguen & Stefan, 2016). Physical and psychological frameworks that inherit particular social functions and roles represent settings (Wicker, 1992). Each BS has a difference in specific social roles that affect future behavior. The interaction between physical objects and human is significant for BS (Barker, 1978). Therefore, BS is defined by the person, the Physical object, the interaction between human-human, and the human-physical object. The activities occurring and their outcomes will vary (fig. 2).

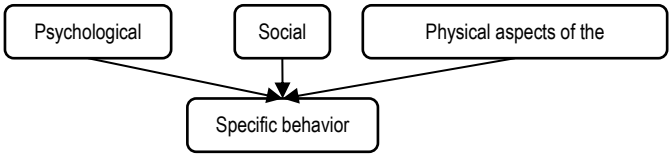

Fig. 2: Concept of behavior setting theory.
(Source:) Adapted from Barker (1978)

Numerous other properties, characteristics, and elements of behavior settings (Popov & Chompalov, 2012). The distinguishing feature of this theory is that these parts have levels. There is a greater interdependence among themselves than interdependence with other parts of other behavior settings (Popov & Chompalov, 2012). In an interdependent system, whether physiological, physical, or

economic, each unit can define any degree of interdependence (Kuhn, 1951). Each behavior setting has a level of interdependence within itself and also found. There is also interdependence between behavior settings (Barker, 1968) (fig. 3).

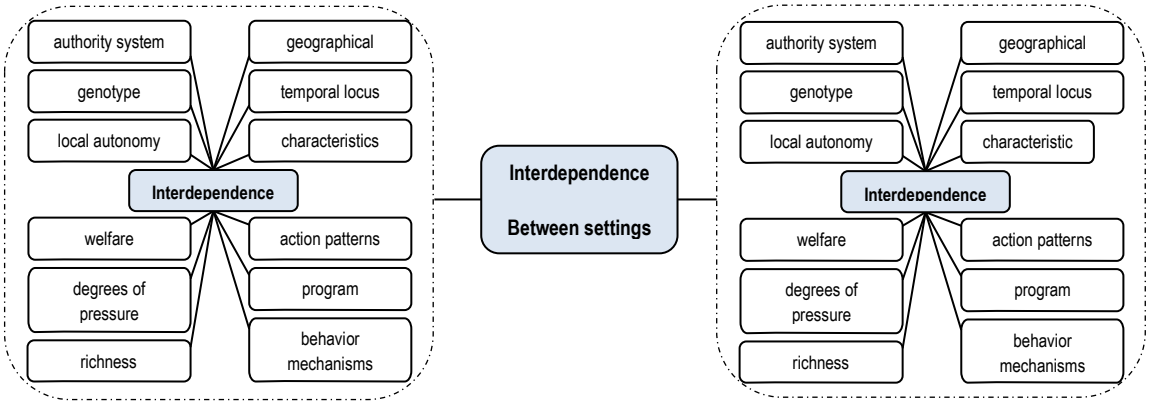

Fig. 3: Concept of behavior setting theory.
(Source:) Adapted from (Barker, 1978; Popov & Chompalov, 2012)

In evaluating the degree of interdependencies between 2 settings, it is assumed that interdependencies between 2 settings can be perceived in the 7 dimensions (von Lindern, 2015), where these 7 dimensions come from the index of interdependence (K). The more each dimension occurs in the same way, the more dimension of the 2 settings has interdependence.

Table 2. 7 dimensions of perceived setting interdependencies.

Dimension	Meaning
Behavior	Behavior that occurs in one setting extends to another where one setting has little or no impact on the other. For example, settings of a meeting room where meetings are being held, and a lounge with food and beverage might occur. Events where dining behavior in the lounge setting happens in a meeting room, etc.
Person(population)	The same people from setting a and setting b, e.g., students from math class, entered to game center, but no one on the staff of the game center entered math class.
Leaders	math teacher as a leader of the math class, meanwhile manager as a leader of the game center.
Location (space)	space of math class, space of the game center
Time	events that occur at the same time.
Object	objects related to psychological needs which remind setting a, while in setting b.
Cognition (Mechanism)	Ideally, the same as when it was in setting a, even though it is now in setting b.

(Source:) Adapted from Schoggen (1989)

Having Interdependence between settings is also a factor that makes it more difficult for us to acquire a sense of psychological distance from work-related responsibilities, personal life issues, and daily hassles (von Lindern, 2017)

The attention restoration study found that the natural environment can relieve mental fatigue, and it seems possible that interdependence between the two settings may affect the constraint of the process of restorative mental fatigue.

5.3 Relationship between attention restoration and interdependencies affect mental fatigue.

BS can be considered recreational behavior in an environment that is typically used for restoration. According to a study by von Lindern (2015) about human-environment transactions, People who spend their free time in wilderness park experience a decrease in the sense of being away and less restorative effects when they are aware of the people and activities they encounter at work. This is due to the interdependence between BS and their association with daily stress and demands. Moreover, a study by von Lindern (2017) found that when individuals perceive interdependencies Increasingly between work environment and leisure-time settings, a sense of being away and self-reported health-related outcomes were restricted. (fig. 4).

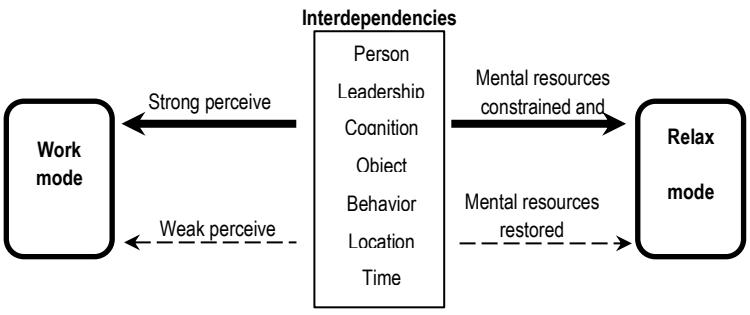

Fig. 4: Perceived setting interdependencies of two settings between work mode and relax mode.
(Source:) Adapted from von Lindern (2017)

Considering the relationship between the components of PSI and ART in terms of behavior, to achieve soft fascination, the environment should contain attractive stimuli, and the individual must readily respond to the soft fascination environment (Kaplan, 2001). The smell of cooking from the cafeteria kitchen may waft into the classroom, creating an appetite for students' lunch breaks. This affects being away. Person and leader, if meeting colleagues in the recreation area can result in retrospect a workplace incident, the incidence of being away will be reduced. Location affects to an extent because climate impedes activity. Hartig, Catalano, et al. (2007) caused an obstruction of access to the area. Objects that do not promote restoration, such as trash and construction parts, affect fascination, and the last is cognition. Mental distance from a task or situation that makes it impossible to stop thinking can constrain the sense of being away. In addition, limited experience may affect the ability to meet individual needs. (compatibility)

The components of attention restoration are related to the interdependence of behavior setting in terms of a conceptual framework there is less empirical evidence in this relationship with the physical environment, and further study is needed.

6.0 Conclusion& Recommendations

Interdependence of behavior setting can affect mental fatigue in relation to the component of attention restoration theory. However, the strength of evidence on how attention restoration theory affects interdependence still needs to be improved. From the previous literature, there is little literature on a component of attention restoration theory's effects on interdependence resulting in limitations in the paper selected for this study.

Moreover, different types of urban spaces can positively influence a variety of mood dimensions and recovery (Rapuano et al., 2022). This review highlights the diversity of evidence around attention restoration and behavior setting in terms of populations, study design, and outcomes.

Paper Contribution to Related Field of Study

This study fills a gap in our understanding of restorative environments by focusing on the restorative transaction process for mental fatigue-related interdependencies of behavior settings. This study also seeks to present evidence regarding the many sources of constraint restoration. The study results serve as a conceptual framework for an architect, landscape architect, and urban designer to improve the quality of life in urban cities and assist them in determining a park design that fulfills the users' needs.

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