CAPSTONE READING PIECES

NCSP 73024 – GROUP 4

Abstract

The articles used in this document have been taken directly from their original sources and have been converted to a word document in order for us to adjust their font-sizes to align with the specifications of each of our tests

Table of Contents

DISCLAIMER!

The articles below have been taken directly from their original sources and manipulated accordingly to fit the specifications of each test. No alterations have been made to the content of the article, merely font size changes and layout.

INSTRUCTIONS:

- The aim of the experiment is to monitor eye movement and aspect ratio change while the participant reads.
- The participant is required to sit between 30-60cm away from the screen.
- The participant is required to read **ANY** portion of the article below for **1 minute.**
- Each time the alarm sounds, the instructor will make a note.
- No sunglasses will be allowed.
- No caps or hats allowed.
- 'Zoom' will be set to 100% for **ALL** tests

Test 1

1. This test will be conducted while the participant is sitting on **a chair at a desk.**
2. Screen Brightness: **100%**

Test 2

3. This test will be conducted while the participant is sitting on **a bed.**
4. Screen Brightness: **100%**

Test 3

5. This test will be conducted while the participant is sitting on **a chair at a desk.**
6. Screen Brightness: **20%**

Test 4

7. This test will be conducted while the participant is sitting on **a bed.**
8. Screen Brightness: **20%**

Test 5

9. Firstly, the test conductor will call out a series of consecutive numbers from 1 to 20 which you as the participant will need to look at on the screen.
10. The test conductor will then call out 10 numbers between 1 and 100 which you will need to look at on the screen.

READING PIECE 1: 4 STAGES OF SLEEP

Specifications:

- Font Size: 20
- Number of Words: 2138

Introduction

Sleep is an important part of your daily routine—you spend about one-third of your time doing it. Quality sleep – and getting enough of it at the right times -- is as essential to survival as food and water. Without sleep you can't form or maintain the pathways in your brain that let you learn and create new memories, and it's harder to concentrate and respond quickly. Sleep is important to a number of brain functions, including how nerve cells (neurons) communicate with each other. In fact, your brain and body stay remarkably active while you sleep. Recent findings suggest that sleep plays a housekeeping role that removes toxins in your brain that build up while you are awake. Everyone needs sleep, but its biological purpose remains a mystery. Sleep affects almost every type of tissue and system in the body – from the brain, heart, and lungs to metabolism, immune function, mood, and disease resistance. Research shows that a chronic lack of sleep, or getting poor quality sleep, increases the risk of disorders including high blood pressure, cardiovascular disease, diabetes, depression, and obesity. Sleep is a complex and dynamic process that affects how you function in ways scientists are now beginning to understand. This booklet describes how your need for sleep is regulated and what happens in the brain during sleep.

Anatomy of Sleep

Several structures within the brain are involved with sleep. The hypothalamus, a peanut-sized structure deep inside the brain, contains groups of nerve cells that act as control centres affecting sleep and arousal. Within the hypothalamus is the suprachiasmatic nucleus (SCN) – clusters of thousands of cells that receive information about light exposure directly from the eyes and control your behavioural rhythm. Some people with damage to the SCN sleep erratically throughout the day because they are not able to match their circadian rhythms with the light-dark cycle. Most blind people maintain some ability to sense light and are able to modify their sleep/wake cycle. The brain stem, at the base of the brain, communicates with the hypothalamus to control the transitions between wake and sleep. (The brain stem includes structures called the pons, medulla, and midbrain.) Sleep-promoting cells within the hypothalamus and the brain stem produce a brain chemical called GABA, which acts to reduce the activity of arousal centres in the hypothalamus and the brain stem. The brain stem (especially the pons and medulla) also plays a special role in REM sleep; it sends signals to relax muscles essential for body posture and limb movements, so that we don't act out our dreams.

The thalamus acts as a relay for information from the senses to the cerebral cortex (the covering of the brain that interprets and processes information from short- to long-term memory). During most stages of sleep, the thalamus becomes quiet, letting you tune out the external world. But during REM sleep, the thalamus is active, sending the cortex images, sounds, and other sensations that fill our dreams. The pineal gland, located within the brain's two hemispheres, receives signals from the SCN and increases production of the hormone melatonin, which helps put you to sleep once the lights go down. People who have lost their sight and cannot coordinate their natural wake-sleep cycle using natural light can stabilize their sleep patterns by taking small amounts of melatonin at the same time each day. Scientists believe that peaks and valleys of melatonin over time are important for matching the body's circadian rhythm to the external cycle of light and darkness. The basal forebrain, near the front and bottom of the brain, also promotes sleep and wakefulness, while part of the midbrain acts as an arousal system. Release of adenosine (a chemical by-product of cellular energy consumption) from cells in the basal forebrain and probably other regions supports your sleep drive. Caffeine counteracts sleepiness by blocking the actions of adenosine. The amygdala, an almond-shaped structure involved in processing emotions, becomes increasingly active during REM sleep.

Sleep Stages

There are two basic types of sleep: rapid eye movement (REM) sleep and non-REM sleep (which has three different stages). Each is linked to specific brain waves and neuronal activity. You cycle through all stages of non-REM and REM sleep several times during a typical night, with increasingly longer, deeper REM periods occurring toward morning. Stage 1 non-REM sleep is the changeover from wakefulness to sleep. During this short period (lasting several minutes) of relatively light sleep, your heartbeat, breathing, and eye movements slow, and your muscles relax with occasional twitches. Your brain waves begin to slow from their daytime wakefulness patterns. Stage 2 non-REM sleep is a period of light sleep before you enter deeper sleep. Your heartbeat and breathing slow, and muscles relax even further. Your body temperature drops and eye movements stop. Brain wave activity slows but is marked by brief bursts of electrical activity. You spend more of your repeated sleep cycles in stage 2 sleep than in other sleep stages. Stage 3 non-REM sleep is the period of deep sleep that you need to feel refreshed in the morning. It occurs in longer periods during the first half of the night. Your heartbeat and breathing slow to their lowest levels during sleep. Your muscles are relaxed and it may be difficult to awaken you. Brain waves become even slower. REM sleep first occurs about 90 minutes after falling asleep. Your eyes move rapidly from side to side behind closed eyelids. Mixed frequency brain wave activity becomes closer to that seen in wakefulness. Your breathing becomes faster and irregular, and your heart rate and blood pressure increase to near waking levels. Most of your dreaming occurs during REM sleep, although some can also occur in non-REM sleep. Your arm and leg muscles become temporarily paralyzed, which prevents you from acting out your dreams. As you age, you sleep less of your time in REM sleep. Memory consolidation most likely requires both non-REM and REM sleep.

Sleep Mechanisms

Two internal biological mechanisms–circadian rhythm and homeostasis–work together to regulate when you are awake and sleep. Circadian rhythms direct a wide variety of functions from daily fluctuations in wakefulness to body temperature, metabolism, and the release of hormones. They control your timing of sleep and cause you to be sleepy at night and your tendency to wake in the morning without an alarm. Your body's biological clock, which is based on a roughly 24-hour day, controls most circadian rhythms. Circadian rhythms synchronize with environmental cues (light, temperature) about the actual time of day, but they continue even in the absence of cues. Sleep-wake homeostasis keeps track of your need for sleep. The homeostatic sleep drive reminds the body to sleep after a certain time and regulates sleep intensity. This sleep drive gets stronger every hour you are awake and causes you to sleep longer and more deeply after a period of sleep deprivation. Factors that influence your sleep-wake needs include medical conditions, medications, stress, sleep environment, and what you eat and drink. Perhaps the greatest influence is the exposure to light. Specialized cells in the retinas of your eyes process light and tell the brain whether it is day or night and can advance or delay our sleep-wake cycle. Exposure to light can make it difficult to fall asleep and return to sleep when awakened. Night shift workers often have trouble falling asleep when they go to bed, and also have trouble staying awake at work because their natural circadian rhythm and sleep-wake cycle is disrupted. In the case of jet lag, circadian rhythms become out of sync with the time of day when people fly to a different time zone, creating a mismatch between their internal clock and the actual clock.

How Much Sleep Do You Need?

Your need for sleep and your sleep patterns change as you age, but this varies significantly across individuals of the same age. There is no magic “number of sleep hours” that works for everybody of the same age. Babies initially sleep as much as 16 to 18 hours per day, which may boost growth and development (especially of the brain). School-age children and teens on average need about 9.5 hours of sleep per night. Most adults need 7-9 hours of sleep a night, but after age 60, night-time sleep tends to be shorter, lighter, and interrupted by multiple awakenings. Elderly people are also more likely to take medications that interfere with sleep. In general, people are getting less sleep than they need due to longer work hours and the availability of round-the-clock entertainment and other activities. Many people feel they can "catch up" on missed sleep during the weekend but, depending on how sleep-deprived they are, sleeping longer on the weekends may not be adequate.

Dreaming

Everyone dreams. You spend about 2 hours each night dreaming but may not remember most of your dreams. Its exact purpose isn’t known, but dreaming may help you process your emotions. Events from the day often invade your thoughts during sleep, and people suffering from stress or anxiety are more likely to have frightening dreams. Dreams can be experienced in all stages of sleep but usually are most vivid in REM sleep. Some people dream in colour, while others only recall dreams in black and white.

The Role of Genes in Neurotransmitters

Chemical Signals to Sleep

Clusters of sleep-promoting neurons in many parts of the brain become more active as we get ready for bed. Nerve-signalling chemicals called neurotransmitters can "switch off" or dampen the activity of cells that signal arousal or relaxation. GABA is associated with sleep, muscle relaxation, and sedation. Norepinephrine and orexin (also called hypocretin) keep some parts of the brain active while we are awake. Other neurotransmitters that shape sleep and wakefulness include acetylcholine, histamine, adrenaline, cortisol, and serotonin.

Genes and Sleep

Genes may play a significant role in how much sleep we need. Scientists have identified several genes involved with sleep and sleep disorders, including genes that control the excitability of neurons, and "clock" genes such as Per, tim, and Cry that influence our circadian rhythms and the timing of sleep. Genome-wide association studies have identified sites on various chromosomes that increase our susceptibility to sleep disorders.

Also, different genes have been identified with such sleep disorders as familial advanced sleep-phase disorder, narcolepsy, and restless legs syndrome. Some of the genes expressed in the cerebral cortex and other brain areas change their level of expression between sleep and wake. Several genetic models–including the worm, fruit fly, and zebrafish–are helping scientists to identify molecular mechanisms and genetic variants involved in normal sleep and sleep disorders. Additional research will provide better understand of inherited sleep patterns and risks of circadian and sleep disorders.

Sleep Studies

Your health care provider may recommend a polysomnogram or other test to diagnose a sleep disorder. A polysomnogram typically involves spending the night at a sleep lab or sleep centre. It records your breathing, oxygen levels, eye and limb movements, heart rate, and brain waves throughout the night. Your sleep is also video and audio recorded. The data can help a sleep specialist determine if you are reaching and proceeding properly through the various sleep stages. Results may be used to develop a treatment plan or determine if further tests are needed.

Track Sleep Through Smart Technology

Millions of people are using smartphone apps, bedside monitors, and wearable items (including bracelets, smart watches, and headbands) to informally collect and analyse data about their sleep. Smart technology can record sounds and movement during sleep, journal hours slept, and monitor heart beat and respiration. Using a companion app, data from some devices can be synced to a smartphone or tablet, or uploaded to a PC. Other apps and devices make white noise, produce light that stimulates melatonin production, and use gentle vibrations to help us sleep and wake.

Tips for Getting a Good Night's Sleep

Getting enough sleep is good for your health. Here are a few tips to improve your sleep:

- Set a schedule – go to bed and wake up at the same time each day.
- Exercise 20 to 30 minutes a day but no later than a few hours before going to bed.
- Avoid caffeine and nicotine late in the day and alcoholic drinks before bed.
- Relax before bed – try a warm bath, reading, or another relaxing routine.
- Create a room for sleep – avoid bright lights and loud sounds, keep the room at a comfortable temperature,

and don’t watch TV or have a computer in your bedroom.

- Don’t lie in bed awake. If you can’t get to sleep, do something else, like reading or listening to music, until you feel tired.
- See a doctor if you have a problem sleeping or if you feel unusually tired during the day. Most sleep disorders can be treated effectively.

END OF READING PIECE 1

READING PIECE 2: COMPUTER VISION SYNDROME (DIGITAL EYE STRAIN)

Specifications:

- Font Size: 14
- Number of Words: 2111

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Abstract

Computer vision syndrome, also known as digital eye strain, is the combination of eye and vision problems associated with the use of computers (including desktop, laptop and tablets) and other electronic displays (e.g. smartphones and electronic reading devices). In today's world, the viewing of digital screens for both vocational and avocational activities is virtually universal. Digital electronic displays differ significantly from printed materials in terms of the within-task symptoms experienced.

Many individuals spend 10 or more hours per day viewing these displays, frequently without adequate breaks. In addition, the small size of some portable screens may necessitate reduced font sizes, leading to closer viewing distances, which will increase the demands on both accommodation and vergence. Differences in blink patterns between hard-copy and electronic displays have also been observed.

Digital eye strain has been shown to have a significant impact on both visual comfort and occupational productivity, since around 40% of adults and up to 80% of teenagers may experience significant visual symptoms (principally eye strain, tired and dry eyes), both during and immediately after viewing electronic displays. This paper reviews the principal ocular causes for this condition, and discusses how the standard eye examination should be modified to meet today's visual demands. It is incumbent upon all eye care practitioners to have a good understanding of the symptoms associated with, and the physiology underlying problems while viewing digital displays.

As modern society continues to move towards even greater use of electronic devices for both work and leisure activities, an inability to satisfy these visual requirements will present significant lifestyle difficulties for patients.

Gaze Angle

A pertinent issue is the specific gaze angle being adopted when viewing digital devices. This can present a significant problem during the eye examination, as it may be difficult to replicate in the examination room, particularly when a phoropter is being used. Long et al. (2014) noted that, while desktop and laptop computers are most commonly viewed in primary and down gaze, respectively (although this may vary with a desktop computer if multiple monitors are being used), hand-held devices such as tablet computers and smartphones may be positioned in almost any direction, sometimes even being held to the side, thereby requiring head and/or neck turn. Given that the magnitude of both heterophoria (Von Noorden 1985) and the amplitude of accommodation (Rosenfield 1997) can vary significantly with the angle of gaze, it is important that testing be conducted using conditions that replicate the habitual working conditions as closely as possible.

Text Size

In addition, the size of the text being observed, particularly on hand-held devices, may be very small. For example, Bababekova et al. (2011) reported a range of visual acuity demands when viewing a webpage on a smartphone from 6/5.9 to 6/28.5 (with a mean of 6/15.1). While this may not seem overly demanding, it should also be noted that an acuity reserve is required to allow comfortable reading for a sustained period of time. Attempting to read text of a size at or close to the threshold of resolution for an extended interval may produce significant discomfort (Ko et al. 2014). Kochurova et al. (2015) demonstrated that a two-times reserve was appropriate for young, visually normal subjects when reading from a laptop computer, i.e. for sustained comfortable reading, the text size should be at least twice the individual's visual acuity. However, higher values may be necessary for older patients, or individuals with visual abnormalities. Therefore, the smallest-sized text recorded by Bababekova et al. (2011) (around 6/6) would necessitate near visual acuity of 6/3. Few, if any, practitioners record near visual acuity to this degree during a standard eye examination.

Glare

Some patients may report significant discomfort from glare while viewing digital screens. Accordingly, it is important that optometrists discuss both appropriate lighting and the use of window shades, as well as proper screen and operator positioning. Any reflections on the computer display, desktop equipment and/or input devices from windows and luminaires are likely to result in both symptoms and a loss of work efficiency. Relatively simple advice regarding the placement of desktop screens perpendicular to fluorescent tubes, and not directly in front of or behind an unshaded window may be extremely beneficial to the patient. For older patients with less transparent ocular media, the effects of glare may be more disabling. For these individuals, a valuable clinical test is to measure visual resolution in the presence Computer vision syndrome (a.k.a. digital eye strain) 3 of a glare source, such as the Marco brightness acuity tester (Marco Ophthalmic, Jacksonville, FL, USA). In order to provide useful advice on the placement of localised lighting (such as a desk lamp for an individual who needs to be able to view both a desktop or laptop monitor and hard-copy printed materials simultaneously), careful questioning by the optometrist as to the precise task requirements is critical.

Dry Eye

Dry eye has previously been cited as a major contributor to DES. For example, Uchino et al. (2008) observed symptoms of dry eye in 10.1% of male and 21.5% of female Japanese office workers using visual display terminals. Furthermore, longer periods of computer work were also associated with a higher prevalence of dry eye (Rossignol et al. 1987). In an extensive review, Blehm et al. (2005) noted that computer users often report eye dryness, burning and grittiness after an extended period of work. Rosenfield (2011) suggested that these ocular surface-related symptoms may result from one or more of the following factors:

- Environmental factors producing corneal drying. These could include low ambient humidity, high forced-air heating or air-conditioning settings or the use of ventilation fans, excess static electricity or airborne contaminants.
- Increased corneal exposure. Desktop computers are commonly used with the eyes in the primary position, whereas hard-copy text is more commonly read with the eyes depressed. The increased corneal exposure associated with the higher gaze angle could also result in an increased rate of tear evaporation. It should also be noted that laptop computers are more typically used in

downward gaze, while both tablet computers and smartphones can be held in either primary or downward gaze.

- Age and gender. The prevalence of dry eye increases with age and is higher in women than men (Gayton 2009; Salibello and Nilsen 1995; Schaumberg et al. 2003)
- Systemic diseases and medications. Moss et al. (2000, 2008) reported that the incidence of dry eye was greater in subjects with arthritis, allergy or thyroid disease not treated with hormones. Additionally, the incidence was higher in individuals taking antihistamines, antianxiety medications, antidepressants, oral steroids or vitamins, as well as those with poorer self-rated health. Perhaps surprisingly, a lower incidence of dry eye was found with higher levels of alcohol consumption.

Blink Rate

Another explanation for the higher prevalence of dry-eye symptoms when viewing digital screens may be due to changes in blink patterns. Several investigations have reported that the blink rate is reduced during computer operation (Patel et al. 1991; Schlote et al. 2004; Tsubota and Nakamori 1993; Wong et al. 2002). For example, Tsubota and Nakamori (1993) compared the rate of blinking in 104 office workers when they were relaxed, reading a book or viewing text on an electronic screen. Mean blink rates were 22/minute while relaxed, but only 10/minute and 7/minute when viewing the book or screen, respectively. However, these three testing conditions varied not only in the method of presentation, but also in task format. It has been noted that blink rate decreases as font size and contrast are reduced (Gowrisankaran et al. 2007), or the cognitive demand of the task increases Table 2. Tests of accommodation and vergence that should be included in an assessment of the near-vision system for a viewer of digital screens. Accommodation testing refers to pre-presbyopic patients only Accommodation testing Subjective amplitude of accommodation (push-up or minus lens) Accommodative response at preferred working distance (Cross–Nott retinoscopy) Monocular and binocular accommodative facility (±2.00 lenses or Hart chart) Negative and positive relative accommodation Vergence testing Near point of convergence Distance and near heterophoria (near to be performed at the preferred and/or required working distance) Presence of A- and V-patterns Horizontal fixation disparity/associated phoria at preferred and/or required working distance Vergence facility (using 12Δ base-out/3Δ base-in prisms or Hart chart) Base-in and base-out vergence ranges Stereopsis Computer vision syndrome (a.k.a. digital eye strain) 5 (Cardona et al. 2011; Himebaugh et al. 2009; Jansen et al. 2010). Therefore, the differences observed by Tsubota and Nakamori may be related to changes in task difficulty, rather than being a consequence of changing from printed material to an electronic display. Indeed, a recent study in our laboratory compared blink rates when reading identical text from a desktop computer screen versus hard-copy printed materials (Chu et al. 2014). No significant difference in the mean blink rates was found, leading to the conclusion that previously observed differences were more likely to be produced by changes in cognitive demand rather than the method of presentation.

While screen use may not alter the overall number of blinks, Chu et al. (2014) observed a significantly higher percentage of incomplete blinks when subjects read from a computer (7.02%) in comparison with reading hard-copy, printed materials (4.33%). However, it is uncertain whether changes in cognitive demand also alter the percentage of incomplete blinks. This may be important, given that a significant correlation was found between post-task symptom scores and the percentage of blinks deemed incomplete (Chu et al. 2014). Interestingly, increasing the overall blink rate (by means of an audible signal) does not produce a significant reduction in symptoms of DES (Rosenfield and Portello 2015). This might imply that it is the presence of incomplete blinks, rather than changes in the overall blink rate, that is responsible for symptoms. McMonnies (2007) reported that incomplete blinking would lead to reduced tear layer thickness over the inferior cornea, resulting in significant evaporation and tear break-up. Current work in our laboratory is examining the effect of blink efficiency exercises to reduce the rate of incomplete blinking on DES symptoms.

The Role of Genes in Neurotransmitters

Chemical Signals to Sleep

Clusters of sleep-promoting neurons in many parts of the brain become more active as we get ready for bed. Nerve-signalling chemicals called neurotransmitters can “switch off” or dampen the activity of cells that signal arousal or relaxation. GABA is associated with sleep, muscle relaxation, and sedation. Norepinephrine and orexin (also called hypocretin) keep some parts of the brain active while we are awake. Other neurotransmitters that shape sleep and wakefulness include acetylcholine, histamine, adrenaline, cortisol, and serotonin.

Genes and Sleep

Genes may play a significant role in how much sleep we need. Scientists have identified several genes involved with sleep and sleep disorders, including genes that control the excitability of neurons, and "clock" genes such as Per, tim, and Cry that influence our circadian rhythms and the timing of sleep. Genome-wide association studies have identified sites on various chromosomes that increase our susceptibility to sleep disorders.

Also, different genes have been identified with such sleep disorders as familial advanced sleep-phase disorder, narcolepsy, and restless legs syndrome. Some of the genes expressed in the cerebral cortex and other brain areas change their level of expression between sleep and wake. Several genetic models–including the worm, fruit fly, and zebrafish–are helping scientists to identify molecular mechanisms and genetic variants involved in normal sleep and sleep disorders. Additional research will provide better understand of inherited sleep patterns and risks of circadian and sleep disorders.

Sleep Studies

Your health care provider may recommend a polysomnogram or other test to diagnose a sleep disorder. A polysomnogram typically involves spending the night at a sleep lab or sleep centre. It records your breathing, oxygen levels, eye and limb movements, heart rate, and brain waves throughout the night. Your sleep is also video and audio recorded. The data can help a sleep specialist determine if you are reaching and proceeding properly through the various sleep stages. Results may be used to develop a treatment plan or determine if further tests are needed.

Summary

Your health care provider may recommend a polysomnogram or other test to diagnose a sleep disorder. A polysomnogram typically involves spending the night at a sleep lab or sleep centre. It records your breathing, oxygen levels, eye and limb movements, heart rate, and brain waves throughout the night. Your sleep is also video and audio recorded. The data can help a sleep specialist determine if you are reaching and proceeding properly through the various sleep stages. Results may be used to develop a treatment plan or determine if further tests are needed.

END OF READING PIECE 2

<u>READING PIECE 3:</u> EFFECTS OF BACKGROUND MUSIC ON CONCENTRATION OF WORKERS

Specifications:

- Font Size: 8
- Number of Words: 1622

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Received 2 December 2008

Accepted 6 September 2009

Abstract.

***Objective*:** Background music is a common element in daily living and the workplace. Determination of whether background music affects human work concentration is a relevant concern. Studies have found background music influences human behavior, and this study attempts to understand how background music and listener fondness for types of music affects worker concentration.

***Methods*:** This study analyses how different types of background music – and how listeners' degree of preference for the background music can affect listener concentration in attention testing through Randomized Controlled Trial (RCT).

Participants: Data were collected from 89 workers. The participants ranged in age between 19 and 28 years old, with an average age of 24 years old.

***Results*:** We conclude background music influenced listener attention. This influence has more to do with listener fondness for the music than with type of music. Compared to situations without background music, the likelihood of background music affecting test-taker attention performance is likely to increase with the degree to which the test-taker likes or dislikes the music.

Conclusions: It is important not to select music that workers strongly like or dislike when making a selection of background music to avoid negatively affecting worker concentration.

Introduction

Numerous investigations have studied the various workplace factors from considerations of hardware equipment to how air quality influences human work performance [16]. However, few documented studies have examined how stimuli such as music and sounds can influence the task performance of individual Background music is very popular in hotels, restaurants, offices, banks, shops, and hospitals [11]. Some therapists have indicated appropriate usage of background music can help increase the effectiveness of therapy [13,20]. This study examines whether background music affects the behavior or attention of individuals in work environments, and whether music helps stimulate improved work performance. Scheufele introduced background music into a job training group for chronic psychotic patients and found background music can help trainees focus, reduce anxiety, and complete job assignments more quickly [19].

Another investigation concluded when employees work while listening to music, their work performance and morale improve, and their satisfaction with the company increases [17]. Ravaja and Kallinen found background music stimulus increased the interest of some newspaper readers and helped them concentrate on reading; yet the same stimulus negatively affected some other participants [18]. At numerous job sites, such as stores and hospitals, people listen to music of many types including popular music, while working. Numerous psychologists and management specialists studied the possible effects of music on human behavior in the workplace [2,12,22].

Background music can alter human behavior [17]. With regard to the rhythm of background music, Szabo demonstrated individuals engaged in exercise pick up pace to match music with a faster tempo, and slow pace to match music with a slower tempo [21]. Music tempo may influence the heartbeat of listeners. Edworthy and Waring found when background music has fast tempo, listeners performing exercise will experience faster heartbeat; the same effect is observed in the case of background music with loud volume. These phenomena may indirectly influence work performance [7]. According to one survey of 24 graduate students, fast tempo background music can increase work efficiency [15]. One study of group therapy demonstrated different types of background music – classical music, popular music, traditional Chinese music, and no music at all – influenced the occurrence of frequency of inappropriate behaviors of patients with psychosis [20].

Evans and Johnson studied typewriting effectiveness and found background noise in the office can affect worker typing efficiency [8]. Furnham concluded the influence of background music on work efficiency varies according to type of music and work [9]. Furnham and Allass compared the effects of background music with and without lyrics, and found instrumental music can improve the reading comprehension performance of listeners, whereas songs with lyrics tend to distract listeners [10]. Furnham and Strbac found in a cognitive test, participants performed best in silence, background music was second best for performance, and background noise was lowest results. Compared to silence, both background music and background noise can negatively impact work performance [11]. However, precisely which factors cause background music to positively influence work performance and which factors do the opposite is unclear and deserves further study. No previous study has explored the effects of appreciation of background music on worker concentration.

Researchers conducted cognitive tests while examining the possible influence of background music on participant cognitive testing scores [4,11]. This investigation examines the influence of background music on participant scores in attention tests. This work attempts to gain a preliminary understanding of the possible influence of background music on individual focus and attention during task performance with a Randomized Controlled Trial (RCT). This study follows previous studies in examining the influence of background music on participant performance incognitive testing [4,11]. Using "attention" as the research index, this work gauges' test-taker preference for background music while analysing how type of background music influences attention.

This study examines the following hypotheses:

Hypothesize 1: Compared to the absence of background music, background music may influence attention test scores.

Hypothesize 2: Compared to the absence of background music, background music becomes more likely to affect attention test scores when the participant strongly likes or dislikes that background music

Method

This pilot study used a Randomized Controlled Trial (RCT).

Research Participants

Eighty-nine voluntary workers (52 females and 37 males) enrolled in the on job bachelor's degree program of a university in Taipei city. The participants ranged in age between 19 and 28 years old, with an average age of 24 years old.

Research Equipment

"Chu's Attention Test" is a standard evaluation tool frequently used in occupational therapy in China [3]. This test is used to predict attention level in community services. The written test includes over 100 questions, each of which requires the test taker to view a series of scrambled codes, search for the "*" sign among these codes, and count the occurrences of "*" for the test duration of 1 minutes. The final score is obtained by deducting "Number of wrong answers" from "Total number of answers."

R.-H. Huang and Y.-N. Shih / Effects of background music on concentration of workers

Table 1
Attention test score of four groups with different kinds of background music

	N	Mean	Std. deviation
Group One (no background music)	23	104.87	11.99
Group Two (popular songs)	22	93.91	31.97
Group Three (classical light music)	20	98.20	24.38
Group Four (traditional Chinese music)	24	96.96	25.40

Background Music: The researchers prepared samples of three types of music of 10 minute segments each.

- Popular music: Five bestselling popular songs from the previous year.
- Classical light music: Five excerpts from the music of Pachelbel, Bach, and other composers.
- Traditional Chinese music: Five short pieces of instrumental music.

Tool for Statistical Analysis: The SPSS15.0 statistics software.

Research Procedure

Step one: Eighty-nine volunteers were randomly divided into four groups. The age and sex of the four groups has no difference by ANOVA analysis.

Step two: Chu's Attention Test was administered to all four groups. The 23 participants in Group One were tested in a quiet environment. The 22 Group Two participants were tested in an environment with a background of pop music. The 20 Group Three participants were tested in an environment with classical light music. The 24 Group Four participants were tested in an environment with traditional Chinese music.

Step three: Following the test, participants belonging to groups Two, Three, and Four were asked to assess the background music using a Likert Scale ranging from 1 to 5, where 1 indicates strongly dislike, 2 denotes dislike, 3 denotes neither like nor dislike, 4 denotes like, and 5 denotes strongly like.

Step four: ANOVA was applied to analyse both how different types of background music can influence attention test performance; and how participant preference for background music can influence attention test score.

Results

Attention Test Scores and the Type of Background Music

The attention test results indicate test takers exposed to background music tend to score lower than those without such exposure (see Table 1). The average attention test score for Group One (no background music) was 104.9. Group Two (popular songs) had an average score of 98.2, while Group Three (classical light music) had an average score of 93.9, and Group Four (traditional Chinese music) had an average score of 96.9. However, ANOVA analysis showed no significant difference between the three background music groups and the no music group.

Attention Test Scores and Degree of Liking for Background Music

Participants in groups Two, Three and Four were asked to rate level of liking for the background music on a scale ranging from1 to 5. Compared to Group One (no background music), participants assigning extreme scores to the background music (either strongly liked or strongly disliked) tended to exhibit lower attention test scores (see Table 2). The difference between these subjects with strong feelings regarding the background music and those in the no background music group was statistically significant (sig. = 0.028; 0.005).

Conclusion

Background music has been used widely in numerous kinds of work environments [1]. This study using "attention" as the research index concluded listener attention was influenced by background music perception when doing a task. However, this phenomenon was related to listener feelings regarding the background music rather than the type of music selected by the researchers. This study found that comparative to a situation with no background music, the influence of background music on listener attention test score increases with the intensity of listener feelings regarding the background music. Thus, when selecting background music for work environments, such as offices, factories,

and therapy rooms, it is important to avoid music that workers strongly like or dislike. Avoiding such music can help avoid unduly impacting listener attention and, consequently, work performance. This investigation gathered data from a sample pool comprising of just 89 individuals.

Subsequent study of the influence of background music in work environments should utilize more attention test tools and a larger number of test samples. Further studies should examine additional music types and worker fondness for a wider variety of music in order to produce stronger and more diversified results.

END OF READING PIECE 3

With the assistance of the test conductor, please proceed to Test 5.