Master thesis

Exploring a sleepiness framework
The effect of sleepiness on interpersonal adaptability, and the role of time pressure, chronotype, tenure, agreeableness and extraversion in the relationship

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Abstract
People spend a great portion of their life either sleeping or working. The modern working environment is filled with hectic work schedules and an increasing demand for international teamwork which have wide variety of influences on an individual. As the connection between sleepiness and work outcomes hasn’t been thoroughly researched, this paper explored the relationship between time pressure and sleepiness, as well as an increasingly important work outcome, namely interpersonal adaptability. Other assessed relationships were with tenure acting as a moderator, and chronotype, extraversion and agreeableness as control variables. The assessed relationships were based on a sleepiness framework by Mullins and colleagues (2014). The convenience sample consisted of 125 students from a university in the south of Sweden. Data was collected using a self-report measure and analyzed using path analysis. Results gave support for two hypotheses out of six: (1) Time pressure is a significant predictor of daytime sleepiness, and (2) extraversion and agreeableness significantly predict interpersonal adaptability. It was concluded that time pressure, extraversion and agreeableness should be considered in future research of sleepiness and interpersonal adaptability. Additionally, it is recommended to use more behavior-based and less self-evaluative measures in future research.

Keywords
Sleepiness; time pressure; interpersonal adaptability; chronotype; tenure; personality; agreeableness; extraversion

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Exploring a sleepiness framework

Sleepiness has been described as one of the “main problems of modern society” (Curcio, Casagrande, & Bertini, 2001, p. 251). Much research in diverse fields shows that sleepiness is widespread and that it can have various negative effects on people’s daily lives. For example, research has shown that driving while sleepy is a major safety hazard (Goncalves et al., 2015), that excessive daytime sleepiness is found in nurses and presents an occupational health issue for them (Suzuki, Ohida, Kaneita, Yokoyama, & Uchiyama, 2005), and that sleepiness is significantly related to worse school performance in children and adolescents (Dewald, Meijer, Oort, Kerkhof & Bögels, 2010). The modern work environment of shift work and having extreme working rhythms has been identified as one of the factors that might be influencing the appearance of sleepiness and thus affecting the health of employees (Curcio, Casagrande, & Bertini, 2001). Mullins, Cortina, Drake, & Dalal (2014) argue that people spend the majority of their life either working or sleeping, making working and the workplace an inevitable part of daily life. However, according to them the connection between these two variables has not been thoroughly researched.

Another important factor that characterizes modern workplace is that most work in organizations is done in some type of team, and with the increasing globalization of the workforce it is becoming even more important to have a good set up of social processes within a team (Lane & Maznevski, 2014). Thus, it could be concluded that being able to communicate well and adapt within diverse interpersonal interactions is becoming a very important skill for navigating work life. One of the dimensions of adaptive performance that depicts the skill needed to function in this type of modern working environment is interpersonal adaptability (Pulakos, Arad, Donovan & Plamondon, 2000).

A search conducted through the PsychINFO database on the 27th of April 2016 for the key terms “sleepiness” and “interpersonal adaptability” gave zero relevant results. In addition to that, Mullins and colleagues (2014) claim that workplace psychology has only very recently started investigating the effect of sleepiness on work processes. They propose that future research should be done on how subjectively and objectively measured sleepiness affects the dimensions of adaptive performance including interpersonal adaptability.

This study’s main aim was to explore the connection between sleepiness and interpersonal adaptability. The concepts, variables and relationships that are tested through this research are based on a framework by Mullins and colleagues (2014) and other relevant research.
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The paper will first describe the framework, followed by descriptions and reasoning for exploring the variables that are presumed to be able to explain the main relationship of interest. This will be followed by the description of method, results and discussion on the meaning of results and possible applications.

A framework of sleepiness at work by Mullins, Cortina, Drake and Dalal (2014)

Mullins and colleagues (2014) identify that sleep problems are reported as common, especially among full time workers. It has also been reported that over a period of 30 years full-time workers have decreased the amount of hours they sleep as the amount of hours they spend working has increased (Knutson, Van Cauter, Rathouz, DeLeire, & Lauderdale, 2010, as cited in Mullins et al., 2014). They have also been identified as carrying a higher risk for sleep disorders than part-time workers (Mullins et al., 2014). Thus, it is evident that sleep quality could be very closely knit with work. Mullins and colleagues (2014) developed a framework that relies on proven physiological effects of sleepiness on people’s functioning and based on that proposes a number of different effects sleepiness might have on workplace outcomes.

Mullins and colleagues (2014) focus on sleepiness as the immediate consequence of sleep problems and they rely on a definition by Dement and Carskadon stating that it is a “craving or desire to sleep” (as cited in Mullins et al., 2014, p. 1097). They assume that sleepiness in the workplace is triggered by sleep loss or sleep restriction and by a low quality of sleep, excluding the sleepiness caused by central nervous system (CNS) disorders and CNS altering substances. According to them, sleepiness is accompanied by physiological changes in the body, which affect several cognitive and affective processes. They state that through information processing and affective mediating mechanisms, sleepiness affects a person’s behavior (Mullins et al., 2014). They argue that sleepiness can lead to poorer information processing through lowering one’s attention capacity, the speed with which information is being processed and one’s working, procedural and implicit memory. The effect of sleepiness on affect is stated to have consequences of lowered ability to recognize and process emotions, as well as to increase negative affect and decrease positive affect in a sleepy individual. Mullins and colleagues (2014) build on these physiological effects of sleepiness on the mentioned cognitive processes and propose a number of relationships between sleepiness and various dimensions of job performance. They state that overall job performance is reduced by sleepiness, more specifically
that it potentially affects the following dimensions of job performance: task performance, adaptive performance and contextual performance. The framework proposes factors present in a workplace that act as antecedents of sleepiness. It proposes that when employees perceive themselves as being under high degrees of time pressure and workloads, and as having low control over their jobs, their sleep quality and quantity could be disrupted. Consequently their sleepiness might increase. The framework also proposes age and morningness/eveningness (chronotype) as moderators of the relationship between desynchronized work schedules and experienced sleepiness, and that task type acts as a moderator in the relationship between sleepiness and performance. With the framework, Mullins and colleagues (2014) give recommendations for future research stating that it is important to investigate mentioned relationships in organizational studies through the use of conceptualizations of work variables present in this field, in order to clarify the connections between sleepiness and workplace behavior.

The purpose of this paper is to explore and provide initial insight into the proposed relationships between time pressure as an antecedent of sleepiness, and sleepiness as the factor that affects interpersonal adaptability, through reduced information and affect processing. This paper is focused on the proposed relationships due to several reasons: (1) Literature research into the topic showed that there is a very small amount of research done on the relationship between interpersonal adaptability and sleepiness, compared to other relationships proposed by the framework. (2) Mullins and colleagues (2014) state that due to the importance of emotion recognition and expression as well as information processing for interpersonal adaptability, this dimension of adaptive performance should be expected to be more influenced by sleepiness. (3) Due to the complexity of the framework and limited resources it was decided to focus just on one set of relationships in order to provide initial information in the exploration of the framework.

Based on the framework and other relevant literature, the effects of tenure, chronotype, and the personality traits of agreeableness and extraversion on the variables and relationships will also be explored. The following parts of the paper will focus on detailed description of the variables researched and hypothesis will be presented. A graphical representation of the variables and relationships that are explored can be seen in figure 1.
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Figure 1. A model of hypothesized relationships.

**Time pressure and Sleepiness**
As mentioned above Mullins and colleagues (2014) state that jobs with high demands including high time pressure could be antecedents of sleepiness due to them reducing sleep quality and quantity. According to Berset, Elfering, Luthy and Semmer (2011) time pressure, described as having to do a lot in a short time, is treated in current research as one of the main stressors in the workplace. According to Roxburgh (2004), research shows that the perception of having more time pressure has increased in the general population, with full time workers and well educated and affluent professionals expressing higher levels of time pressure (Jacobs & Gerson, 1998, as cited in Roxburgh, 2004, p. 117, Robinson and Godbey, 1997 as cited in Roxburgh, 2004, p. 117).

Berset and colleagues (2011) state that although after a normal 9:00 to 17:00 o’clock workday, people should have enough time to recover and relax before going to work, their research does show that people experience “preservative cognitions”. These cognitions can be forms of ruminations that are related through their content to stressors at work and in this way they restart or prolong the physiological reactions to experienced stressors. This disrupts the recovery when the person is not working and disrupts their sleep. In addition, as already mentioned, sleepiness that comes from impaired sleep has a disruptive effect on a person’s information and affect processes. Thus, it could be posed that as time pressure is related to disrupted sleep it could reduce interpersonal adaptability through sleepiness.
H1: The higher the perceived time pressures of an individual the higher their self-reported daytime sleepiness will be.

H2: Perceived time pressure will through the increase of sleepiness lower the perceived interpersonal adaptability.

Sleepiness and Interpersonal Adaptability
Interpersonal adaptability is one of the dimensions of adaptive performance and has many diverse definitions and conceptual inconsistencies (Oliver & Lievens, 2014). Oliver and Lievens (2014, p. 5) summarize the characteristics of interpersonal adaptability based on a couple of diverse definitions of the construct, stating that it is a: “conceptualization of interpersonal effectiveness that takes into account the appropriateness of individuals’ interpersonal thoughts, and feelings of the person within a specific interpersonal interaction”. This definition was presented here in order to emphasize that for a person to be interpersonally adaptive it is important to process information coming from the situation and the other person, and to be able to recognize the emotions properly and react to them. These capabilities according to the framework are more difficult for sleepy people, and thus it is proposed that increased sleepiness will lower the experience of being interpersonally adaptive (Mullins and colleagues, 2014).

H3: The higher the self-reported daytime sleepiness the lower the perceived interpersonal adaptability.

Chronotype
Chronotype is a circadian rhythm preference for a certain time of day when a person feels most productive and alert (Concepcion et al, 2014). While some people feel their best in the morning, others do not peak in function until the afternoon or evening and therefore it has been coined morningness/eveningness chronotype. This difference is evident in self-report measures as well as a person’s oral temperature and food intake (Horne & Östberg, 1976). According to this typology people can either be a morning type, evening type or neither (Adan et al, 2012). Morning types peak in both alertness and performance earlier in the day than evening types who fall asleep, wake up and peak later. According to Adan and colleagues (2012) around 40% of
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adults have the characteristics of one of the two extreme groups, either morning or evening type, while around 60% are in the middle.

There were two reasons chronotype was believed to be a confounding factor on sleepiness in the study: (1) The current study focused on daytime sleepiness. It was hypothesized that since the sleepiness scale was aimed at measuring daytime sleepiness, evening types might measure higher in daytime sleepiness because their peak time is later than for morning types. (2) All participants filled out the questionnaire either in the morning or afternoon. If a person whose peak time is in the evening answered the questionnaire early in the morning, this might negatively affect his or her perception of their general sleepiness, despite the questionnaire asking about their sleepiness in recent times and not at that given moment. In other words, since evening types might be more tired at the time of the survey (e.g. in the morning) than morning types, their sleepiness at the time of the measure might unknowingly influence their answers.

H4: Chronotype will affect a person’s self-reported sleepiness because of the inherent content of the sleepiness questionnaire and because the questionnaires were filled out during a time when some participants might be sleepier than others.

Personality

A factor that could potentially affect employees’ interpersonal adaptability is personality. One widely used personality taxonomy is the Five-factor model of personality, also known as the Big-Five personality traits. It includes five personality domains: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (McCrae & Costa, 1989). These personality traits have been shown to affect various behaviors and attitudes at work, whether it is a main effect of a single trait (Judge, Heller, & Mount, 2002; Judge & Ilies, 2002) or even the combined effect of traits (King, George, & Hebl, 2005).

Although many of these personality traits can certainly affect interpersonal behavior at work (King et al., 2005; Mount & Barrick, 1998) only two of them can be said to be intrinsically interpersonal (McCrae & Costa, 1989), that is extraversion and agreeableness. According to McCrae and Costa (1989), one cannot be agreeable or extraverted without being in contact with other people, as opposed to the other three dimensions, neuroticism, openness to experience, and conscientiousness. Extraversion is characterized by the extent to which a person is comfortable
with relationships (Robbins & Judge, 2013) and according to Robbins and Judge (2013), extraverted people are more assertive, outgoing and sociable, whereas introverts tend to be more reserved and quiet. The trait agreeableness on the other hand refers to a person’s level of cooperation, warmth, and trust towards other people. Agreeable people are often more compliant and conforming than those lower in agreeableness (Robbins & Judge, 2013).

Because of their close connection to interpersonal behavior, extraversion and agreeableness were controlled for to clarify the effect sleepiness has on interpersonal adaptability. According to Jensen-Campbell and Graziano (2001), it is especially important for people with high agreeableness to maintain positive interpersonal relationships. It can therefore be argued that agreeableness can have a confounding effect on a person’s interpersonal adaptability. Furthermore, extraversion has been shown to be strongly correlated with interpersonal skills (Alge, Gresham, Heneman, Fox, & McMasters, 2002), presumably making extraverts better equipped to adapt in interpersonal relationships.

H5: People with a higher score on extraversion and agreeableness will be more interpersonally adaptive than people with a lower score on those traits.

Tenure

When it comes to the effects of sleep restriction on work performance Mullins and colleagues (2014) suggest that age may in some cases play a protective role. However, it is not the biological age itself they assume is the cause, but rather increased experience in dealing with the effects of sleep restriction as one ages. They state that as people age they may evolve certain strategies to limit their performance decline (Mullins, et al., 2014). It was therefore assumed that the longer a person has to perform in a certain situation, the more experience he or she has in dealing with the work demands and potential sleep restriction that may come with it.

H6: Tenure (measured in semesters studied at university level) will moderate the relationship between sleepiness and interpersonal adaptability in that the longer a person has studied, the less sleepiness will affect their interpersonal adaptability.
Method

Participants

Data from a convenience sample of N = 127 was collected. It consisted of students from a University in the south of Sweden. A student sample was chosen because of limited resources. Although this reduces generalizability of results to the workplace it was assumed that the results would still give a good idea of what these relationships would look like for employees, as the variables measured are also relevant for students. Certain similarities are assumed between the tasks in the average workplace and in universities. In both cases, people are required to interact with others in order to achieve set goals and often experience both time pressure and sleepiness.

Two participants were excluded from the study because of a large amount of missing data making it impossible to calculate their total scores for certain scales. This made the total sample used N=125. Participants from following programs were included: Psychology (n = 38), Peace and Development (n = 21), Political Science (n = 14), Social Work (n = 25), Preschool Teaching (n = 16), European studies (n = 1), International social science (n = 4) and International administration (n = 3), with three missing cases in this variable. These programs were chosen in order to control for the amount of formal training in social interaction that the participants have received. It was assumed that these programs encourage thinking about people’s needs, and they include training for future jobs that require a great deal of social interaction skills. Thus, it is assumed that with the similar amount of social interaction training and similar interest toward working for and with people, individual differences in the effect of sleepiness on interpersonal adaptability would be more evident. Another criterion for choosing the programs was due to the purpose of the study, which was the investigation of adaptability while communicating with others. Hence, it was important that the students were required to communicate with their colleagues on a regular basis, therefore only programs that had regular group work were chosen.

70.2% (n = 87) of participants were female. Age range of the participants was 19-43 with a mean age of 24.44. The sample included both bachelor and master students and they had been studying between 1 and 14 semesters at a university level, with a mean of 4.2 semesters. Participants included both Swedish and international students.
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Procedure

Data collection. Teachers of each program were contacted through e-mail and asked for permission to come to their classes to ask students to participate. Students were asked to complete the questionnaire either before or after the class. All participants received the same instructions through a cover page on the questionnaire. The full instruction given to the participants can be found in the appendices. There was no limitation on the time they were given to fill out the survey, but for the majority of participants it took approximately 15 minutes to finish the survey.

Statistical analysis. To test the hypotheses the statistical technique path analysis was conducted. This analysis is a variation of multiple regressions and is usually used to test relationships of a proposed model or theory (Stage, Carter & Nora, 2004). Path analysis enables the researcher to test the relationships between multiple variables and at the same time it allows the variables to assume both the position of an independent variable and dependent variable depending on the proposed relationship (Stage, Carter & Nora, 2004). Path analysis can be used to assess mediation and moderation effects in the model. Mediator is a variable that explains the relationship between the independent and dependent variable (Baron & Kenny, 1986), in other words the independent variable works through the mediator to affect the dependent variable. The mediator in the current research is sleepiness, as it is hypothesized to explain the relationship between time pressure and interpersonal adaptability. A moderator is a variable that affects the strength or direction of the relationship between an independent and a dependent variable (Baron & Kenny, 1986). It was hypothesized that when added to the relationship between sleepiness and adaptability, tenure as a moderator would make the relationship weaker. The proposed model in this paper contains all the above stated elements that can be assessed by the path analysis, and hence it was used to give a comprehensive picture of whether the proposed model within the framework can be supported by the data. To check for mediation effects a Baron and Kenny (1986) approach has been used. For more details about the procedure and assumptions related to the approach, see Baron and Kenny (1986).

Instruments

Interpersonal Adaptability questionnaire (INAD). The measure for interpersonal adaptability was based on a dimension from a taxonomy of adaptive job performance developed
by Pulakos and colleagues (2000). Due to their scale of interpersonal adaptability only being commercially available, a questionnaire was developed based on a description of the interpersonal adaptability dimension that Pulakos and colleagues (2000) identified.

To start the development of a measure for interpersonal adaptability an initial 29-item questionnaire was formed. The psychometric qualities of this questionnaire were then assessed in a pilot study with a sample of 75 participants. The data was analyzed with SPSS version 21 (Statistical Package for Social Sciences) using a principal component analysis to assess whether the 29 items were a part of the same component. Thirteen of the items loaded on the same factor and those items were used to form the final version of the Interpersonal Adaptability (INAD) questionnaire used in the study. The Cronbach’s alpha of the final version of the INAD based on the pilot study was .79. The remaining items reflected all the indicators of the dimension by Pulakos and colleagues (2000) except for one: “Tailoring own behavior to persuade, influence or work more effectively with other people” (Pulakos et al., 2000, p. 617). Although the sample size was smaller than recommended (Field, 2009) the KMO test indicated the sample size was adequate and it was therefore concluded that this questionnaire is an appropriate measure of interpersonal adaptability.

Participants were asked to indicate their agreement to the 13 statements by using a five-point Likert scale. The scale ranged from 1 (“Strongly disagree”) to 5 (“Strongly agree”). Three indicated neutrality towards the statement, that is participants neither agreed nor disagreed. The total score of the scale is achieved by summing up the score for each item and the scores could range from a minimum of 13 to maximum of 65. A higher score indicates higher interpersonal adaptability. Three of the items were inversely scored and were therefore reversed before calculating the total score.

**Epworth Sleepiness Scale (ESS).** Sleepiness was measured with the Epworth sleepiness scale (ESS). The scale is a self-report measure that requires participants to rate the likelihood of dozing off in various situations, as opposed to just feeling tired. Participants are given 8 situations and on a scale from 0 (“would never doze”) to 3 (“high chance of dozing”) they are asked to rate the likelihood of dozing off in each situation, referring to their usual way of life in recent times. This gives a minimum possible score of 0 and highest possible score of 24. Examples of situations are “sitting and reading”, “sitting, inactive in a public place (e.g. a theater or a meeting)”, and “sitting and talking to someone”. The scale has been shown to have a good
internal consistency, and when measured on healthy medical students it had a Cronbach’s alpha of .73 (Johns, 1992).

Although the ESS relies on participants remembering under what circumstances they have or have not dozed off during the day it seems that the ESS nonetheless provides meaningful self-reports on daytime sleepiness. For example, individuals with sleep disorders that are associated with excessive daytime sleepiness reported that they were likely to doze off in situations that were not conducive to sleep in the majority of the normal sleepers (Johns, 1991).

**Time pressure questionnaire.** The time pressure questionnaire developed by Roxburgh, (2002) was used to identify the self-reported experience of time pressure. The scale consists of 9 items which assess the participants’ experience of their life tempo in recent times. Participants rated on a Likert scale from 1 (“strongly disagree”) to 4 (“strongly agree”) how much each statement describes their own experience of time pressures. The result of the scale is calculated by aggregating scores for each item, with the final scale having a score range of 9-36. Higher score indicates higher time pressure. The reported Cronbach’s alpha in previous research indicates a good internal consistency with a score of .89 (Roxburgh, 2002).

**Ten Item Personality Inventory (TIPI).** Participants’ personality traits of extraversion and agreeableness were measured with a short version of the Big-Five questionnaire. This short measure is called the Ten-Item Personality Inventory (TIPI) and contains two items for each dimension; one normal and one reversed item. Only subscales for extraversion and agreeableness were used and therefore there were 4 TIPI items in the questionnaire. Subscales require participants to evaluate their characteristics on a 7-point scale from 1 (“disagree strongly”) to 7 (“agree strongly”).

Since personality was only used as a control variable it was decided that it was a good measure to use because of its short format, despite its relatively low internal consistency coefficients on the extraversion and agreeableness subscales (Cronbach’s alphas of .68, .40, respectively). Since there were a number of different sections in the questionnaire, the TIPI’s short format was thought to counteract potential fatigue that might arise as a result of a long questionnaire. Despite its low internal consistency, the TIPI showed good convergent validity with the Big-Five Inventory in self-, observer, and peer reports. The convergences of the TIPI were comparable to other multi-item inventories (Gosling, Rentfrow, & Swann, 2003).
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**Reduced Horne and Östberg morningness-eveningness questionnaire (rH&O).**

rH&O questionnaire (Chelminski et al, 2000) was used to assess the self-reported preference towards either even-ningness or morningness in people’s circadian rhythm. The questions asked about what times of day a person favors for both rising and going to bed, at what times the person experiences feelings of tiredness or alertness and one question asks a person to self-assess whether they are more of an evening or a morning type. They are multiple choice questions that ask the respondent to choose only one, with each chosen answer carrying a score that is summed up to provide a final score. The questionnaire consists of 5 items and has a range of scores from 4 to 25. Higher scores indicate higher perceived morningness and lower scores indicate higher eveningness. Chelminski and colleagues (2000) checked the psychometric qualities of the scale reporting that the scale is reliable with a Cronbach’s alpha of 0.70.

With chronotype questionnaires a common problem is that normative cutoff points are often not appropriate for different samples (Levandovski, Sasso, & Hidalgo, 2013). This, however, should not be a problem for the current study as the cutoff points for both the original MEQ and the rH&O were based on a sample of young people, ages 18-32 (Horne & Östberg, 1976) and undergraduate students (Chelminski, Petros, Plaud, Ferraro, 2000), respectively. This is a similar age range to the participants in this current study.

**Results**

**Reliability analysis**

Most of the used scales showed good or acceptable reliability. Reliability analysis of the questionnaire INAD showed that the scale was reliable with a Cronbach’s alpha of .74. Upon closer inspection of the results it was shown that items 13 and 7 had a low corrected item total correlation. To understand why these results have appeared the content of the items was reconsidered. Item 13 was: “I usually understand why other people behave the way they do” and item 7 was: “It is easy for me to interact with people from cultures different than my own.” It was concluded that item 7 might reflect a different concept better than interpersonal adaptability, possibly cultural adaptability. Item 13 might not reflect a person’s ability to be interpersonally adaptable but rather to just intellectually understand other people’s behavior without necessarily being willing to adapt to it. Hence, they were deleted from the questionnaire. This resulted in a final INAD questionnaire of 11 items with a Cronbach’s alpha of .76. The final version of the
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INAD questionnaire can be seen in the appendix. The eight item Epworth Sleepiness scale had a Cronbach’s alpha of .67. Although the TIPI subscales consisted of a small amount of items they were still checked for reliability. Extraversion and Agreeableness subscales of the TIPI scale had Cronbach’s alphas of .65 and .38 respectively. These low reliability coefficients were to be expected due to the low number of items, and because of the already mentioned proofs of content validity, the collected data was still used for analysis. The Cronbach’s alpha of the five item rH&O scale was .79. Time pressure scale consisting of nine items had a Cronbach’s alpha of .87.

**Missing cases analysis**

Before analyzing the data, missing cases for relevant variables were identified. Two participants were completely excluded from the analysis because of too many missing answers for total scores on certain scales to be computed. Another variable that had four missing cases was tenure (3.2% of the total data). This variable was checked with a Little’s MCAR test in order to investigate whether the missing data were randomly distributed. It resulted in a $\chi^2 = 1.559$ (df = 1; p = .212). The non-significant results suggested that missing values were randomly distributed and therefore it was appropriate to continue with the Expectation Maximization missing data imputation (EM).

**Path analysis AMOS**

The hypothesized model included a direct relationship between time pressure and sleepiness (H1), and a direct relationship between time pressure and interpersonal adaptability with sleepiness as a mediator in the relationship (H2, H3). Tenure was hypothesized to moderate the relationship between sleepiness and interpersonal adaptability (H6). Three control variables were included in the model: chronotype as a covariate of sleepiness (H5), and extraversion and agreeableness as covariates of interpersonal adaptability (H4). Descriptive statistics are shown in Table 1 for all variables used in the study.
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Table 1
Descriptive Statistics for Variables in the Model. N=125

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>95% CI</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower bound</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper bound</td>
</tr>
<tr>
<td>Time pressure</td>
<td>2.62</td>
<td>0.59</td>
<td>2.67</td>
<td>1.11</td>
<td>3.89</td>
<td>2.51</td>
</tr>
<tr>
<td>Sleepiness</td>
<td>8.14</td>
<td>3.70</td>
<td>8.00</td>
<td>0.00</td>
<td>18.00</td>
<td>7.49</td>
</tr>
<tr>
<td>Interp. adaptability</td>
<td>3.79</td>
<td>0.41</td>
<td>3.77</td>
<td>2.69</td>
<td>5.00</td>
<td>3.72</td>
</tr>
<tr>
<td>Tenure¹</td>
<td>4.25</td>
<td>3.00</td>
<td>3.00</td>
<td>1.00</td>
<td>14.00</td>
<td>3.722</td>
</tr>
<tr>
<td>Chronotype</td>
<td>13.10</td>
<td>4.04</td>
<td>13.00</td>
<td>6.00</td>
<td>25.00</td>
<td>12.38</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>4.69</td>
<td>0.90</td>
<td>4.50</td>
<td>1.50</td>
<td>7.00</td>
<td>4.53</td>
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<tr>
<td>Extraversion</td>
<td>4.38</td>
<td>0.86</td>
<td>4.50</td>
<td>1.00</td>
<td>6.50</td>
<td>4.22</td>
</tr>
</tbody>
</table>

Note: Values are unstandardized. Variables are scored on different scales.
¹Number of semesters studied at university level.
SD = Standard deviation, CI = Confidence interval.

Assessing the model fit

Overall, the data showed that the model was a good fit for the data. The model had 2 degrees of freedom (36-34 = 2) and was therefore over-identified, meaning there was enough data for all the estimated paths to be calculated (Tabachnick & Fidell, 2007). The model had a non-significant chi-square of 1.75 (p = .42), thus not statistically different from the saturated (i.e. the perfect) model. However, other fit indices were checked as well since the chi-square fit index is sensitive to a small sample size and skewed variables (Tabachnick & Fidell, 2007), both of which were present in the current study.

There is a variety of different model fit indices to choose from in path analysis and many are sensitive to sample size. Based on recommendations from Hooper, Coughlan and Mullen (2008) four indices were chosen for the purpose of estimating the model’s fit. They state that these indices have been found to be less sensitive to sample size, model misspecification and estimation of parameters. These were the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI) and the Parsimony Goodness-of-Fit Index (PGFI). Although Hooper and colleagues (2008) note that the PGFI is not as reliable with a sample size below 200, it was used here to get as wide a picture of the model fit as possible. Additionally, very complex models with few degrees of freedom as is the case in the current
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study, sometimes produce too large fit indices. It was therefore decided to use the PGFI as that particular fit index adjusts for the loss of degrees of freedom, to see how it compared to other fit indices. The PGFI seriously punishes complex models and usually results in statistics that are lower than for other indices (Hooper et al., 2008).

The CFI and GFI were both above a cut-off point of 0.95, suggesting that the model was a good fit for the data. The RMSEA was significant with $p < .001$ with a confidence interval of .00 and .17, also suggesting a good fit. The PGFI was .06, indicating a very poor fit as for this index the closer the statistic is to 1, the better the fit of the model (Tabachnick & Fidell, 2007). The path model along with standardized beta coefficients is presented in Figure 2.

Assessing hypotheses
All relationships were in the direction as originally presumed based on existing literature. However, not all hypotheses were supported by the data. Time pressure was a significant predictor of daytime sleepiness as hypothesized and therefore H1 was supported ($\beta = .22$). The path between time pressure and interpersonal adaptability was not statistically significant ($\beta = -.14$), nor was there an indirect relationship between those variables, mediated through sleepiness as originally hypothesized. H2 was consequently rejected. H3 was also rejected, as daytime sleepiness was not a significant predictor of interpersonal adaptability ($\beta = -.02$).
was not a significant predictor of sleepiness (β = -.04) so H4 was rejected. Both extraversion (β = .27) and agreeableness (β = .22) were significant predictors of interpersonal adaptability, thus offering support for H5. Lastly, tenure did not moderate the relationship between sleepiness and interpersonal adaptability (β = -.05) and therefore H6 was rejected. Values are shown in Table 2.

Table 2

Summary of Path Analysis

<table>
<thead>
<tr>
<th></th>
<th>Direct effects</th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>b</td>
<td>β</td>
<td>S.E.</td>
<td>C.R.</td>
</tr>
<tr>
<td>H1 Time pressure --&gt; Sleepiness</td>
<td>1.355</td>
<td>.220</td>
<td>.537</td>
<td>2.524</td>
<td>.012</td>
</tr>
<tr>
<td>H4 Chronotype --&gt; Sleepiness</td>
<td>-.036</td>
<td>-.040</td>
<td>.080</td>
<td>-.447</td>
<td>.655</td>
</tr>
<tr>
<td>Agreeableness --&gt; Sleepiness</td>
<td>.139</td>
<td>.044</td>
<td>.277</td>
<td>.500</td>
<td>.617</td>
</tr>
<tr>
<td>Extraversion --&gt; Sleepiness</td>
<td>.406</td>
<td>.163</td>
<td>.218</td>
<td>1.861</td>
<td>.063</td>
</tr>
<tr>
<td>H3 Sleepiness --&gt; Interp. adaptability</td>
<td>-.003</td>
<td>-.024</td>
<td>.011</td>
<td>-.275</td>
<td>.783</td>
</tr>
<tr>
<td>H5 Agreeableness --&gt; Interp. adaptability</td>
<td>.085</td>
<td>.221</td>
<td>.033</td>
<td>2.590</td>
<td>.010</td>
</tr>
<tr>
<td>H5 Extraversion --&gt; Interp. adaptability</td>
<td>.082</td>
<td>.270</td>
<td>.026</td>
<td>3.164</td>
<td>.002</td>
</tr>
<tr>
<td>Chronotype --&gt; Interp. adaptability</td>
<td>.000</td>
<td>-.004</td>
<td>.010</td>
<td>-.048</td>
<td>.962</td>
</tr>
<tr>
<td>H6 Sleepiness*tenure --&gt; Interp. adaptability</td>
<td>-.024</td>
<td>-.048</td>
<td>.042</td>
<td>-.565</td>
<td>.572</td>
</tr>
<tr>
<td>Tenure --&gt; Interp. adaptability</td>
<td>.015</td>
<td>.104</td>
<td>.012</td>
<td>1.241</td>
<td>.215</td>
</tr>
<tr>
<td>H2 Time pressure --&gt; Interp. adaptability</td>
<td>-.108</td>
<td>-.143</td>
<td>.065</td>
<td>-1.657</td>
<td>.098</td>
</tr>
</tbody>
</table>

Indirect effects

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time pressure --&gt; Interp. Adaptability</td>
<td>.699</td>
</tr>
<tr>
<td>Sleepiness --&gt; Interp. Adaptability</td>
<td>…</td>
</tr>
</tbody>
</table>

b = Regression Weights, β = Standardized Regression Weights, S.E. = Standard Error, C.R. = Critical Ratio

Discussion

The results of the analysis do not support the model fully. Although the tested relationships were in the hypothesized direction, only H1 and H5 were supported by the data. This section of the paper will discuss the obtained results and provide possible reasons for their appearance and future research recommendations will be given.
Exploring a sleepiness framework

The path analysis assessment of the model fit showed contradictory results. Model fit indices mostly suggested that the estimated model was a good fit for the data. However, the Parsimony Goodness-of-Fit Index suggested very poor fit. As mentioned above the PGFI is very punishing of complex models that attempt to estimate many pathways, which might be the reason why in this case the statistic was so low (Hooper et al., 2008). Additionally, the PGFI might have been inaccurate because of the small sample size, as it has been known to be less reliable with samples with less than 200 participants (Hooper et al., 2008).

The results of the hypothesis testing indicated that H1 was supported by the data, indicating that the higher the participants’ experienced time pressure the higher their daytime sleepiness. Previous research has shown that hectic work is a significant predictor of sleep disturbance (Åkerstedt, Fredlund, Gillberg, & Jansson, 2002). According to the framework by Mullins and colleagues (2014) job demands, including time pressure, were proposed to be antecedents of daytime sleepiness through reducing the time spent sleeping and the quality of sleep. Other research has also shown that time pressure’s relation to sleep disturbance could be mediated through ruminations, as well as that unfinished work tasks affected rumination and sleep on the weekends (Syrek, & Antoni, 2014). All of these results from previous research indicate that having high time pressure and not managing to finish work tasks could disturb the sleep of an individual and that the mechanism through which time pressure affects sleep should be more systematically investigated. The current study adds to the existing research of the effect of time pressure on sleep disturbance, confirming the existence of a relationship between time pressure and sleepiness. Understanding the mechanisms in which time pressure affects sleepiness and its workplace outcomes could lead to better understanding in which types of job positions this relationship could be more detrimental. Furthermore, it could help identify what type of practical changes could be made to the workplace in order to ensure reduction of its bad effects. Thus, a recommendation for future research and development of the tested framework would be to include and test different mechanisms through which time pressure could affect sleepiness and its effects on workplace outcomes, e.g. mediating effects of rumination, unfinished tasks etc.

H2 and H3 were not supported by the data. Results indicated that there was no significant probability that sleepiness is a mediator of interpersonal adaptability or that sleepiness is a statistically significant predictor of interpersonal adaptability. Consequently, H6 was also not supported by the data indicating that tenure does not moderate the relationship. As mentioned in
the introduction these relationships have not been the center of research yet, so there is a very small amount of research papers that can be used to explain these results. What can be concluded is that the use of self-report measures could have affected the results. The Epworth sleepiness scale is a questionnaire that treats sleepiness as a stable trait within each individual and it asks participants to subjectively evaluate their sleepiness pattern (Curcio, Casagrande, & Bertini, 2001). Although the participants are directed to think about their sleepiness in recent times, it could still be potentially difficult for them to evaluate when they are sleepy. According to Curcio, Casagrande and Bertini (2001) these types of measures where participants need to evaluate themselves has an issue of evaluations possibly being influenced by the setting in which the questionnaire is given and by the motivation of the participant. In the current study, the questionnaires were given to students during their classes in the presence of their authority figure (teacher) which might have influenced them to try to answer in a socially desirable way, and hence not adequately judge their sleepiness. The same issue could be present in the self-report INAD scale. Hence, a future recommendation would be to use more behavior-based measures to assess how the experienced sleepiness affects the performance in adapting to an interaction that is less reliant on self-evaluations.

Data indicated that H4 was also not supported, that is, that there was no significant effect of chronotype preference on daytime sleepiness. This suggests that chronotype did not act as a confounding factor on daytime sleepiness and did not need to be controlled for. The Epworth sleepiness scale is based on a hypothesis that every person has a certain level of sleepiness regardless of circadian rhythm (Curcio, Casagrande, & Bertini, 2001), thus this measure could have potentially controlled for the effects of chronotype by its design.

H5 was supported by the data indicating that the higher the traits of extraversion and agreeableness, the higher the interpersonal adaptability. The data from the present study suggests that these personality traits should be controlled for when assessing the effect of sleepiness on interpersonal adaptability. If a person is high on extraversion or agreeableness, their interpersonal skills might be more developed and thus they might be more interpersonally adaptable. Hence, in order to investigate the level to which sleepiness might affect the interpersonal adaptability, it might be important to make this distinction.
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Limitations

The current study had certain limitations that reduced its generalizability. These limitations were related to both the methodology and statistical analysis of the data. The first and perhaps most influential limitation was the self-report format of the questionnaire, especially concerning interpersonal adaptability. Whereas for the most part of the questionnaire participants rated rather objective aspects of their lives (e.g. sleepiness, time pressure and chronotype), the content of the INAD required participants to rate an aspect of their behavior they might feel sensitive about. Thus, it is likely that some participants did not answer completely truthfully and consequently distorted the results to a certain extent. Future research could look into ways to avoid the self-report bias, perhaps by having an experimental design instead of questionnaires. A way to accomplish this could for example be by having participants, some sleep deprived and some not, work together on tasks and have trained researchers judge participants’ interpersonal adaptability. Adaptability between sleep deprived subjects and the control group would then be compared. This would eliminate the participants’ subjective evaluation of their own interpersonal adaptability.

A second limitation was that of sample size. Path analysis is considered a method for large samples and decreases in both stability and accuracy as the sample size decreases (Stage, Carter, & Nora, 2004). A common criterion for estimating the necessary number of participants uses Klein’s (1998; as cited by Stage, Carter, & Nora, 2004, and Streiner, 2005) suggestion of having at least 10 cases for each estimated parameter. The current study does not meet those standards and therefore it cannot be said with certainty that the results are fully accurate. However, as previously mentioned, fit indices were specifically chosen with this drawback in mind in order to somewhat counteract this problem. In addition to the sample being too small the lack of a random sampling when collecting data put limitations on the generalizability of the results. Sample size was originally determined based on Cohen’s (1992) suggestions for multiple regression and on access to participants. The chosen sample size, however, is not sufficient to produce reliable results when using path analysis, as it is a method that requires a large sample. A power analysis was conducted using an online calculator that produced a code for the statistical program R. The calculator allows the user to both determine the power of a model as well as the required sample size to get a certain power value. The calculator was based on recommendations from MacCallum, Browne, and Sugawara (1996) and used the RMSEA
statistic, along with the p-value, sample size and degrees of freedom to estimate the power of the model. Results revealed a power of 0.13, which might explain to some extent the lack of statistically significant results. To determine how large the sample would have had to be to get a power of 0.80, the above-mentioned calculator was used. Results indicated that for this particular model a sample size of 644 would have been needed to achieve sufficient power (0.80), which was beyond the scope of this research.

A third limitation was that the data did not meet all the assumptions required for path analysis (Tabachnick & Fidell, 2007). This was for example the case with the assumptions of both univariate and multivariate normality. Because of this, results should be interpreted with caution.

**Conclusion**

The current paper has evaluated a model based on a Mullins and colleagues (2014) framework in order to investigate the effect of sleepiness on interpersonal adaptability. The results do not support the model fully, but do indicate that there is a connection between time pressure and sleepiness, and they support the addition of personality traits of extraversion and agreeableness when assessing interpersonal adaptability. The relationships found were all in hypothesized directions, but a number of them failed to be statistically significant. Therefore it is concluded that research should be continued in the area. Future recommendations for further research of this topic are to include more behavior based and less self-evaluative measures of both sleepiness and interpersonal adaptability. In conclusion, this research gives an initial glance at the relationships and shows that the variables time pressure, extraversion and agreeableness contribute to the understanding of main variables of interest, and should be kept in mind in future exploration of the relationship between interpersonal adaptability and sleepiness.
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References


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Appendices

Appendix A. Instruction page of questionnaire

**Study about sleepiness and communication**

In everyday life you probably encountered students who seem very sleepy while doing their studies and the ones who don’t seem sleepy at all. One of the main characteristics of studying is that you have to communicate with your fellow colleagues to a certain degree in order to get your assignments done. As it is quite common for students to be more or less sleepy while fulfilling their study requirements, this study aims to explore sleepiness and communication with your colleagues in your studies.

This questionnaire includes different sections with questions about your general sleepiness, your personal characteristics, your communication with your colleagues, characteristics of your study program, and the usage of your time.

This questionnaire is a part of our master thesis project in Behavioral Sciences. In order to answer the study’s main question we have chosen to invite students from various faculties at Linnaeus University to participate in this study. That is why we would like to invite you to fill in this questionnaire and help us with our master thesis project. Participation in this research is completely voluntary. If you choose to participate, you may withdraw from the research at any time without any consequences or explanations. We would, however, appreciate that you inform us if you do wish to withdraw.

Some questions may seem a bit unusual, unimportant or repetitive, but we would still like to ask you to answer each one and to answer them honestly. If you are unsure of what to answer, just use the first answer that comes to your mind. It is usually an accurate answer for you.

Please read carefully the instructions for each set of questions before answering them. The questionnaire is anonymous and confidential, and there are no right and wrong answers. We are interested in your own evaluations, so please respond honestly to the questions.
Exploring a sleepiness framework

Your answers will be only used for statistical analysis and the results of the analysis will be written in our master thesis and used to publicly defend the thesis, without any of the individual results of questionnaires being presented.

Thank you for your participation!

Best regards,
Andrea Strinic (student/researcher), email: as223tk@student.lnu.se
Sólveig Dröfn Jónsdóttir (student/researcher), email: sj222pv@student.lnu.se
Associate Professor Andrejs Ozolins (supervisor), email: andrejs.ozolins@lnu.se
Appendix B. Final version of the Interpersonal Adaptability questionnaire (INAD)

Communication

When answering the questions please think of your current situation and the way you interact with your colleagues in the university in order to complete your study obligations.

*Please only think about communication in relation to your studies when answering the following questions*

Based on your experience when communicating with your colleagues related to your studies, please circle a number to indicate how much you agree with each following statement. Description of what each number means is included in the following table:

<table>
<thead>
<tr>
<th>Question</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am flexible in my approach to others.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2. I have difficulties accepting negative feedback.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3. I see negative feedback as the opportunity to grow and understand what I need to improve.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>4. I am open to hearing feedback that will help me to solve my tasks more efficiently.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>5. I enjoy working with very diverse people.</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
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<table>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>6. I can establish a good working relationship with people who are different from me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. It is difficult for me to interact with people that have very different opinions from me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. I usually take well to other people’s suggestions when working with them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. I usually take well to constructive criticism.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. I usually listen to constructive criticism and make efforts to develop myself in accordance to it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. I find it hard to work with people that are very different from myself.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>