

**Effects of Workplace Environment and Personality Traits on Productivity,
Health and Well-Being: A Systematic Review**

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Preface

In completing this bachelor's thesis, I embarked on a journey within the field of psychology. Through research, analysis, and reflection over the past three years, I have been able to delve into the interesting facets of psychology.

I would like to express my gratitude to Lilla Magyari, whose support, guidance, and encouragement as adviser were instrumental throughout this thesis. Her expertise, patience, and dedication played a key role in my research. My deepest gratitude goes to Anniken Skaar Nuland for her continuous support and encouragement throughout my entire bachelor's degree at the University of Stavanger.

Additionally, I extend my appreciation to my family and friends for their encouragement and understanding during the challenges of thesis writing. Their belief fueled my determination to persevere.

As I present this thesis, I do so with humility and enthusiasm, recognizing the significance of our collective efforts in advancing knowledge and understanding in the field of psychology.

Kind regards

Stian Nygård

Abstract

Employees spend a significant portion of their lives at work, and the workplace environment greatly impacts their health and well-being. While research has examined the effects of workplace environment factors and personality traits on health and well-being individually, there is limited research on their complex interaction and their influence on outcomes such as productivity, health and well-being. This systematic review examines ten articles to address this gap. Findings reveal that different office types, including open-plan, closed, and home offices, have varied effects on employee outcomes. Open-plan offices are associated with increased noise levels and distractions, negatively impacting productivity and health across all personality traits, with neuroticism being the most affected trait. Additionally, a lack of privacy is linked to higher rates of sick building symptoms. Personality moderates these effects, with many employees expressing a preference for more private and fixed workspaces due to lower noise levels and distractions. Significant differences are observed in stress, subjective fatigue, and well-being between office types. Conscientiousness emerges as a significant predictor of disability retirement rates compared to other personality traits. However, limitations are noted in the objectivity of productivity measurement instruments. Future research should explore the use of objective measurements in office settings to further understand these dynamics.

Keywords: workplace, workspace, working area, work environment, environment, office space, open plan offices, open office, workstation type, home office, working from home, personality, productivity, creativity, efficiency, happiness, workflow

Introduction

The average full-time worker spends 36 hours per week at work (Labour Market Statistics Time Series [LMS], 2024), amounting to a significant portion of their time in a specific workplace environment. Workplace environments and office types vary across organizations, with an increasing trend towards the adoption of open-plan offices in recent decades (Congdon et al., 2014). Additionally, post-COVID, there has been a rise in hybrid solutions such as working from home (Silver, 2023). Research has established that workplace environment and office type have significant effects on employees' health, well-being, and productivity (James et al., 2021; Oomen et al., 2008). Given the amount of time individuals spend at work, careful consideration should be given to the architectural design of workplace environments and other factors that may impact its occupants. Furthermore, employees themselves possess unique personality traits, which could play a crucial role in mediating the relationship between workplace environment and health, subjective well-being, and productivity. Failure to consider this variable could lead to long-term negative consequences for both the individual and the organization. Therefore, this review aims to explore the complex interplay between workplace environment and personality traits on productivity, health, and well-being.

1.1 Workplace Environment on Productivity, Health and Well-Being

Workplace environment and office types have been directly correlated with various effects on productivity, health, and well-being (James et al., 2021; Oomen et al., 2008; Baranski et al., 2023). Open-plan office layouts are often considered cost-effective and promote communication and collaboration among employees. However, they have also been associated with several negative effects, including decreased concentration levels, reduced productivity, lower job satisfaction, increased workplace conflict, heightened stress levels,

fatigue, and a higher risk of disease transmission. The recent COVID-19 pandemic has highlighted the risks posed by open-plan and shared work environments, underscoring the importance for organizations to carefully consider the potential impacts of their workspaces on employee health and well-being (James et al., 2021). Additionally, elevated noise levels in open-plan offices can significantly impair productivity. Studies have shown differences in workers' ability to function in private offices compared to open-plan settings (Bodin & Bodin Danielsson, 2008). Furthermore, workplace environmental factors have been linked to increased sick leave rates (Pejtersen et al., 2011), suggesting that the workplace environment may indirectly impact an organization's profitability (Markussen, 2012). Given the significant effects of workplace environment on employee well-being, research in this area is of great importance.

1.2 Big Five Personality Model

Personality is defined as the enduring characteristics and behaviors of which a person's unique adjustment to life comprises of. This includes major traits such as interests, values, self-concept, abilities as well as emotional patterns (American Psychological Association Dictionary of Psychology, 2019). One of the most well-known and established personality theories is the Five Factor Model, also known as Big Five (Costa & McCrae, 1995). Big Five divides personality into five dimensions; surgency or extraversion, agreeableness, conscientiousness, emotional stability, and culture or intellect, now more commonly referred to as openness (Norman, 1963). Big Five appears to be replicable in studies when using English trait words for its items (Goldberg, 1981). The Big Five measures a person's personality taxonomy through either single-word trait adjectives such as being talkative, moody, or imaginative (Goldberg, 1990), or by use of sentences (McCrae & Costa 1999).

1.3 Extraversion

Extroverts are known for their talkative and socially active behavioral pattern and are usually more impactful on their social environment (Wolf & Kim, 2012). People high in extraversion are bolder, as well as being associated with higher levels of positive affect (Berry & Miller, 2001; Hampson, 2012). Levels of extraversion are also associated with different effects on the workplace, such as being more co-operative (Hirsch & Peterson, 2009).

1.4 Agreeableness

Individuals high in agreeableness are known for their ability to get along with others, are low in aggressiveness, and their tendency to avoid social conflict with others (Graziano & Tobin, 2002). Agreeable individuals have high degrees of empathy and show this in their social interactions with others, often being forgivable to their colleagues (Strelan, 2007). In the workplace, agreeable people are known for their likeability, selflessness, cooperativeness, helpfulness, tolerance, flexibility and sympathy (Digman, 1990).

1.5 Conscientiousness

People high in conscientiousness are known for their hard-working attitude and reliable behaviour (Conard, 2006). In the workplace, individuals high in conscientiousness are more disciplined, diligent, dependable, methodical as well as purposeful (Witt et al., 2002).

1.6 Emotional Stability

Emotional stability is a personality trait commonly measured by looking at the way an individual handles stressors, with the polar opposite of emotional stability being neuroticism

(Murray et al., 2002). Neuroticism is strongly associated with experiencing more fatigue, more variability in mood, and in general experiencing a lower subjective well-being than their counterparts (Costa & McCrae, 1980). In the workplace, neuroticism is not directly correlated to a worsening of productivity in an office setting (Smillie et al., 2006), but it is however correlated to the tendency of self-handicapping (Ross et al., 2002). Self-handicapping is defined as the process in which a person creates or chooses obstacles to behavior or a performance setting, for the purpose of protecting their self-esteem in response to an esteem-threatening situation. Some of these behaviors include learned-helplessness, procrastination, success avoidance and self-fulfilling prophecies of negative expectations (Curtis, 2012).

1.7 Openness

One of the key characteristics of individuals high in openness is their behavior and attitude towards new experiences (Buss, 1993). Individuals high in openness tend to be more intellectually curious, more creative and appear to have a stronger imagination than their peers. Furthermore, this creativity is one of the key traits that differentiate individuals high in openness to their colleagues in the workplace (George & Zhou, 2001).

Methodology:

2.1 Search and Screening

The present review aims to find articles on the specific effects of workplace environment and personality on outcome variables productivity, health and well-being. Due to varying terminology of workplace in office environment research, several different keywords have been used to encapsulate the maximum amount of studies on the subject. Keywords have been inspired by articles regarding the topic, as well as being inspired by James et al., (2021).

A search was conducted on Scopus February 29th, 2024, a flowchart of this process is presented in figure 2.

The search resulted in 478 articles. All articles were exported as CSV and brought into excel, where they went through a systematic selection process based on the inclusion criteria. Titles and abstracts were screened, of which 18 were relevant to the research question. Studies were excluded for the following reasons: Only researched the role of personality on productivity, with no/sub-par definition of the physical working environments effect on this relationship (n=1) (Biggio & Cortese, 2013), previous version of a study included (n=1) (Kawakubo & Arata, 2022), did not present empirical data between the specific relationship between workplace environment and personality traits (n=4) (Rogers & Barber, 2019; Laura & Cioca, 2018; Laura et al., 2019; Tonello, 2004), sub-par sample size and poor definition of workplace environment (n=1) (D'Antoine et al., 2023), text not available after request (n=1) (Lindberg et al., 2016). After full text screening, 10 studies remained.

2.2 Inclusion Criteria

All studies were evaluated with the following inclusion criteria; Must be peer reviewed, must contain comparable empirical data, must look at the specific relationship between personality and workplace environmental factors on key variables, must specify instrument of measurement on key variables. Conference papers, book chapters, meta-analysis, case studies and unethical studies were excluded from consideration. Articles were screened in Kanalregisteret. Limits on Scopus were set to only include articles published in English, and to only show papers that are published as articles.

Table 1

Office type	Characteristics
1. Cell office	Single person office cell, fully enclosed, full height walls, permanent occupier
2. Shared-room office	2-3 Persons office cell, fully enclosed, full height walls, permanent occupiers
3. Small open plan	4-9 Persons office room/environment (no/limited partitions), permanent occupants
4. Medium-sized open plan	10-24 Persons office room/environment (no/limited partitions), permanent occupants
5. Large open plan	>24 Persons office room/environment (no/limited partitions), permanent occupants
6. Flex office	Open plan, non-permanent occupants, flexible workstations, no personalization
7. Combi office	Open plan & Cell (depending on given work tasks), partly permanent occupants, larger use of shared work facilities
8. Cubicles with low partitions	Individual workstations, < 60 inches
9. Cubicles with high partitions	Individual workstations, ≥ 60 inches
10. Open plan office with no or limited partitions	Same as types 3-5, however with no statement of occupants, no/limited partitions
11. Home-office	Individual workstation, working from home, permanent occupant
12. Open plan, laboratory setting	Same as 3-5, however in a laboratory setting with no permanent occupants, no/limited partition

Table 1: Office type categorization, inspired by Bodin Danielsson & Bodin (2008) and James et al., (2021). Adapted to include home-office layout and type for laboratory settings.

Results

3.1 Key Results

The purpose of this study is to analyze the relationship between workplace environment and personality, and how these two factors affect productivity, health, and well-being. Several key findings emerged from the included studies. The impact of workplace environment on productivity and well-being was found to be statistically significant in many studies (Oseland & Hodsman, 2018; Roskams et al., 2019; Franke & Nadler, 2021; Arata & Kawakubo, 2023), although there were a few exceptions (Baranski et al., 2023). Similarly, several personality traits showed significant effects. Among the five main personality traits presented in the BFI, neuroticism, openness, and extraversion were found to have the most significant effects on productivity and health in relation to workplace environment (Oseland & Hodsman, 2018; Arata & Kawakubo, 2023; Nielsen et al., 2021).

A key predictor of the impact of workplace environment on productivity was noise levels and distraction (Franke & Nadler, 2021; Oseland & Hodsman, 2018; Golmohammadi et al., 2021; Needle & Mallia, 2021). Different office types were associated with varying noise levels, which, in turn, significantly affected subjective annoyance, fatigue, stress, and

productivity among employees. One study reported objective findings demonstrating that workplace environment significantly increased rate of disability retirement (Nielsen et al., 2021).

Differences were also found when comparing instruments used for measuring productivity and well-being. Larger effects on performance were found when it was self-reported, compared to the objectively measured performance across workstation types (Baranski et al., 2023). Different levels of productivity were also found when comparing employees working from home and in an office (Arata & Kawakubo, 2023). Different personality traits showed differing preferences in workplace environment, with levels of user satisfaction on physical characteristics of the office (Hartog et al., 2018). Other demographic variables such as age and gender were found to enhance the strength of this relationship (Roskams & Haynes, 2020). Overall, a majority of workers concluded with preferring a more private workspace compared to an open-plan layout (Needle & Mallia, 2021).

Figure 1

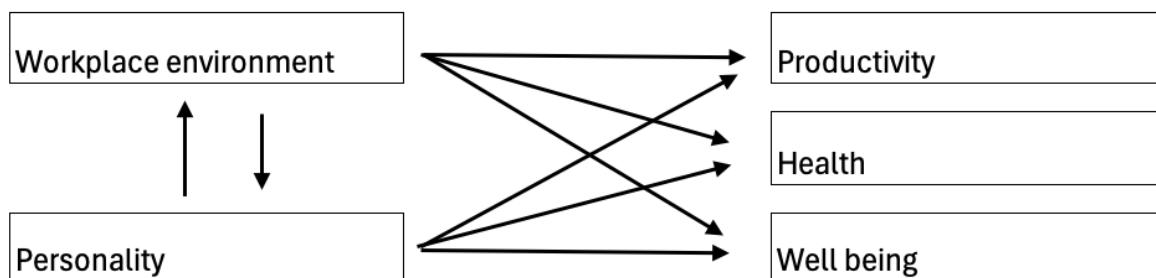


Figure 1: Simplified version of figure 3. Arrows between the variable's workplace environment and personality, on productivity, health and well-being presenting the effects of these. The arrow from personality to workplace environment representing preference in environmental factors. The arrow from workplace environment to personality representing the effect workplace environments have on the different personality traits.

3.2 Study Characteristics

The studies were conducted in seven different countries. Most of them were conducted in western-European and English-speaking countries, with the exception of the studies by Arata & Kawakubo (2023) and Golmohammadi et al., (2021). The percentage distribution between male/female among the studies vary with the lowest female percentage being 0% (Golmohammadi et al., 2021) and the largest being 65% (Needle & Mallia, 2021). Sample sizes vary substantially in size (N=31-6779). Two studies did not specify what industries their samples were in (Nielsen et al., 2021; Roskams & Haynes, 2020), and two studies were conducted in a laboratory setting (Franke & Nadler, 2021; Golmohammadi et al., 2021).

To create similar comparisons between articles, office environments have been categorized into 12 types by use of an adapted version of Bodin Danielsson & Bodins (2008) definitions of office types as well as James et al (2021). This categorization also includes a definition of home office (11) and considers laboratory specific office-space configuration (12). Table 1 shows two of the three dimensions discussed in this review, specific office environments and personality inventory. Outcome variables for each studies have been categorized into outcome dimensions in table 1. Use of dimensions is due to the substantial amount of similar but differently defined outcome variables. The main outcome dimensions categories are (1) Productivity PRO (2) Potentially counterproductive PCP (3) Health HEA (4) Well-being WB. The definition of PRO encompasses work ranging from simple office task productivity to cognitively demanding tasks. PRO includes measurements of productivity that are measured subjectively as well as objectively. PCP is a definition of measurement on environmental variables such as noise and disturbance that could potentially negatively affect employees in an organization. The definition of HEA aims to group the effects that directly affect the physical health of employees. Finally, outcome variables that

affect the mental well-being, satisfaction or comfort of employees falls into the WB category. Instruments for measurement have also been categorized based on their subjectiveness or objectivity. Self-report questionnaires and online surveys are considered subjective, whilst observational measurements and experimental tasks are considered objective.

Figure 2

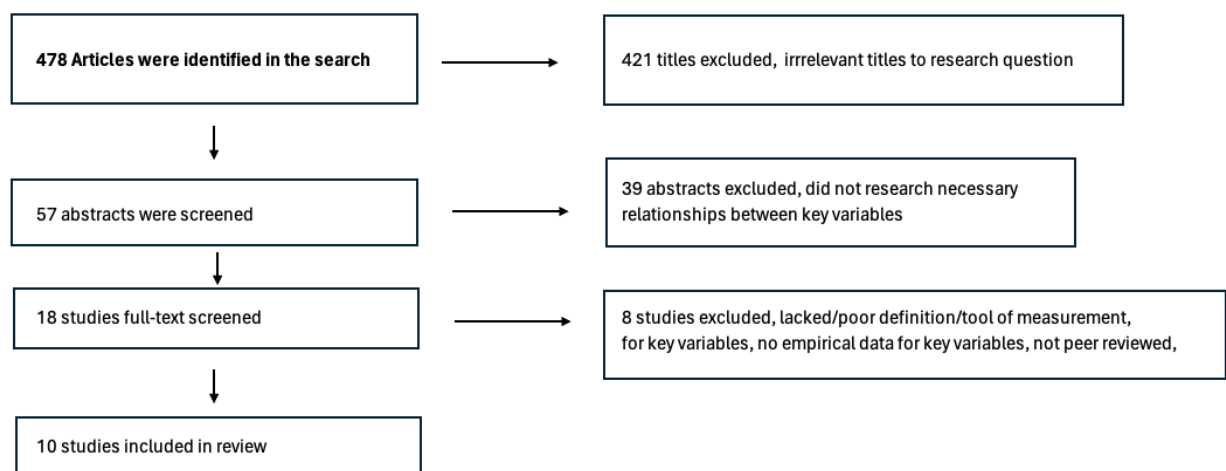


Figure (2) Flowchart showing the procedure of inclusion of studies used in this review

3.3 Workplace Environment on Productivity

There are mixed results regarding the relationship between workstation type and productivity. A multiple linear regression analysis of momentary focus on workstation type found the relationship to be not statistically significant (Baranski et al., 2023). Arata & Kawakubo (2023) and Roskams et al., (2019) found similar results. A binomial logistic regression analysis of simple task productivity showed that frequency of working from home (FWH) as an explanatory variable (exp.b) for simple task productivity had an odds ratio of 1.37 ($\beta=0.32$) (Arata & Kawakubo, 2023). An online survey presented to individuals working

in creative industries, showed that open work environments were distracting (50%), but did however not sabotage work efficiency (Needle & Mallia, 2021).

Statistically significant differences were found when correcting for occupations (Arata & Kawakubo, 2023). Clerical work had a substantial increase in simple task productivity (+10.4%) when increasing days FWH, compared to sales (8.9%) and technical (2.5%). Knowledge processing/creation had an overall decrease for all professions, with the least affected being sales (-0.0%, $p=.189$, -1.6%, $p=.424$), but this decrease was not of statistical significance. Overall, benefits in productivity when working from home appears to be affected by occupation, with simple office tasks such as clerical work being the most affected.

In a survey assessment, private office workers were associated with significantly higher global focus compared to those working in open bench seating ($\beta=-18.34$) and cubicles ($\beta=17.84$) (Baranski et al., 2023). Differences in productivity are also found when analyzing the effect of subjective concentration, distraction and disturbance by speech were found when comparing open plan layouts and home offices to closed offices (Oseland & Hodsman, 2018). On a five-point scale where one is considered as the best option, open plan office layouts score worse in all dimensions. Open plan rated concentration (2.6), distraction (2.6), and distraction by speech (2.9). Cellular offices rated concentration (2.4), distraction (2.3), and disturbance by speech (2.6). Finally, home offices rated concentration (2.4), distraction (2.3), and disturbance by speech (2.2). Overall, workers across different occupations rate the design of their workspace design better in reducing noise induced distractions than those who work at open plan desks ($\eta^2=0.04$) (Oseland & Hodsman, 2018).

3.4 Workplace environment on Health and Well-Being

A statistically significant effect was established between the specific office type and health status. Respondents working in open plan offices (3.7%) and shared offices (4.1%)

were significantly ($p < .05$) more likely for disability retirement compared to respondents in cellular offices (2.9%) (Nielsen et al., 2021). A cox regression analysis with age and underlying timescale was concluded to look at the impact of office design on risk of disability retirement. Respondents working in shared offices and open-plan offices had a significantly higher risk of disability retirement compared to respondents working in cellular offices as reference (Nielsen et al., 2021) Table 6 shows that self-reported work ability had a significant effect on reducing the likelihood of disability retirement. Female respondents were significantly more likely for disability retirement compared to male respondents. Work ability, sickness, gender, and low levels of conscientiousness remained as predictors for disability retirement in the final model. Respondents working in shared and open plan offices had a significantly higher risk of disability retirement compared to cellular office workers.

In general, well-being is rated lower among employees working in open-plan offices (Oseland & Hodsman, 2018). In the same five-point scale previously mentioned, open-plan office employees rated their well-being lower (3.9), compared to cellular office (2.1) and home office (2.4). Removing amount of available space per employee, removing partitions and increasing temperature increases sick building syndrome symptoms (SBS) (Franke & Nadler, 2021). These factors have statistically significant effects on SBS. Participants in a laboratory setting were divided into three groups, T1 (N=6), T2 (N=6) and T3 (N=12), where tangible independent variables temperature and indoor air quality (IAQ), as well as intangible variables (ergonomics, privacy) were manipulated.

Table 2

	Measured variable	Instrument	Objectivity	Outcome Dimension	Abbreviation
Arata & Kawakubo (2023)	Productivity of information processing	Classification of Productivity (IPRC, 2012*)	Subjective	Productivity	PRO
	Productivity of knowledge processing	Classification of Productivity (IPRC, 2012)	Subjective	Productivity	PRO
	Productivity of knowledge creation	Classification of Productivity (IPRC, 2012)	Subjective	Productivity	PRO
	Comprehensive productivity	Classification of Productivity (IPRC, 2012)	Subjective	Productivity	PRO
Baranski et al., (2023)	Global focus	Positive and Negative Affective Survey (Watson et al., 1988)	Subjective	Productivity	PRO
	Global happiness	Positive and Negative Affective Survey (Watson et al., 1988)	Subjective	Well being	WB
	Momentary focus	Circumplex model of affect (Russel, 1980)	Subjective	Productivity	PRO
	Momentary happiness	Circumplex model of affect (Russel, 1980)	Subjective	Well being	WB
Franke & Nadler (2021)	Satisfaction (Indoor Environmental Quality)	IEQ (Zagreus et al., 2004)	Subjective	Well being	WB
	Satisfaction (Indoor Air Quality)	IAQ (Gunnarson & Fanger, 1992)	Subjective	Well being	WB
	Satisfaction (Thermal comfort)	TC(ASHRAE, 2005)	Subjective	Well being	WB
	Health (Sick building syndrome)	SBS Symptoms (Andersson et al., 1988)	Subjective	Health	HEA
	Productivity (Self assessed performance)	SAP Adapted item from (Zagreus et al., 2004)	Subjective	Productivity	PRO
	Productivity (Perceived performance)	PP (Koch et al., 1999)	Subjective	Productivity	PRO
	Typical office work (TYPE A)	Proofreading/Addition (Harp & Mayer, 1997; Liebl, 2006)	Objective	Productivity	PRO
	Cognitive Demanding task	CRA/SVT* (Landmann et al., 2014; Royer et al., 1987)	Objective	Productivity	PRO

Table 2 (continued)

Golmohammadi et al., (2021)	Noise induced annoyance	100 Point noise annoyance scale (ISO/TS 15666, 2003)	Subjective	Potentially counterproductive	PCP
	Mental workload (MWL)	NASA TLX* (Cao et al., 2009)	Subjective	Well being	WB
Hartog et al., (2018)	User satisfaction	Adapted version of Maanveid et al., (2009)	Subjective	Well being	WB
Needle & Mallia (2021)	Ability to focus (potential productivity)	Original online survey (Needle & Mallia, 2021)	Subjective	Productivity	PRO
Nielsen et al., (2021)	Self reported work ability	Work ability index (WAI);24)	Subjective	Productivity	PRO
	Disability/Medical absence	Sickness and Disability registry from NAV	Objective	Health	HEA
Oseland & Hodsman (2018)	Percentage performance	Original online survey (Oseland & Hodsman, 2018)	Subjective	Productivity	PRO
	Ability to carry out work	Original online survey (Oseland & Hodsman, 2018)	Subjective	Productivity	PRO
	Well being	Original online survey (Oseland & Hodsman, 2018)	Subjective	Well being	WB
	Stress	Original online survey (Oseland & Hodsman, 2018)	Subjective	Well being	WB
	Productivity	Original online survey (Oseland & Hodsman, 2018)	Subjective	Productivity	PRO
	Concentration	Original online survey (Oseland & Hodsman, 2018)	Subjective	Productivity	PRO
	Distraction	Original online survey (Oseland & Hodsman, 2018)	Subjective	Potentially counterproductive	PCP
	Speech	Original online survey (Oseland & Hodsman, 2018)	Subjective	Potentially counterproductive	PCP
Roskams & Haynes (2020)	Concentration	Original online survey (Roskams & Haynes, 2020)	Subjective	Productivity	PRO
	Task heterogeneity	Original online survey (Roskams & Haynes, 2020)	Subjective	Productivity	PRO
	Susceptibility to distraction	Original online survey (Roskams & Haynes, 2020)	Subjective	Potentially counterproductive	PCP
Roskams et al., (2019)	Disturbance by speech	Original online survey (Roskams et al., 2019)	Subjective	Potentially counterproductive	PCP
	Difficulties in concentration	Original online survey, item adapted from Kaartiela-Tuomaala et al., (2019)	Subjective	Potentially counterproductive	PCP
	Work engagement	Original online survey, item adapted from Utrecht Work Engagement Scale (Schaufeli et al., 2002)	Subjective	Productivity	PRO
	Office productivity	Original online survey, item adapted from Haynes (2008)	Subjective	Productivity	PRO

* Intellectual Productivity Research Committee

* Compount Remote Associate / Sentence Verification task

* Task Load Index

Table 2, Measurement variables of all studies included, divided into four dimensions (1) Productivity (2) Potentially Counterproductive (3) Health (4) Well being

Figure 3

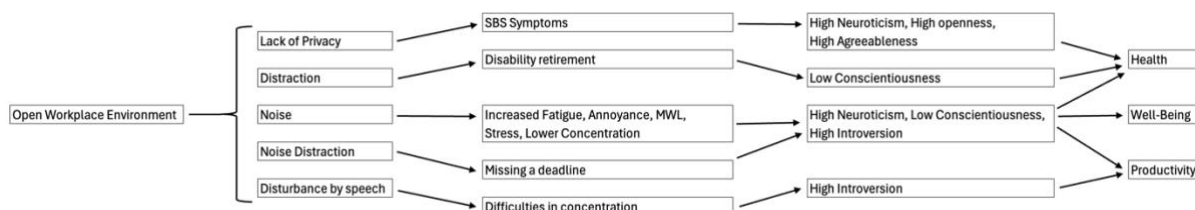


Figure 3: Path model of the effects different workplace environments create. Open workplace environments create PCP variables such as lack of privacy, distraction, noise, noise distraction, and disturbance by speech. These variables lead to different negative effects such as sick building syndrome (SBS) symptoms, disability retirement, missing a deadline and difficulties in concentration. They can also lead to increased fatigue, annoyance, mental workload (MWL), and stress, as well as negatively affect concentration. These negative effects are shown to have statistically significant relations with different personality traits. Finally, the last part addresses which dimension this effect categorizes as.

Statistically significant effects were found between lack of privacy in workplace environment and an increase in the following SBS symptoms; heaviness in head ($r=-0.258$), headache ($r=-0.194$), dizziness ($r=-0.197$), poor concentration ($r=0.258$). However, a subjective measurement of concentration as an operationalization of productivity did not show any statistically significant effect when removing privacy (Franke & Nadler, 2021).

Table 3:

	SBS symptom				
	Drowsiness	Heaviness in the head	Headache	Dizziness	Poor concentration
Thermal sensation	0.067	0.139*	0.148**	0.097	0.031
IAQ	-0.132*	-0.327***	-0.292***	-0.229***	-0.233***
Ergonomics	-0.041	-0.108	-0.074	-0.048	-0.172**
Privacy	-0.080	-0.258***	-0.194***	-0.197***	-0.258***

SBS = Sick Building Syndrome, IAQ = Indoor Air Quality.
 *** $p < .01$, ** $p < .05$, * $p < .1$.

Table 3: Correlations of Indoor Environmental Quality (IEQ) and SBS Symptoms. Extracted from Franke & Nadler (2021)

Table 4:

	Tangible			Intangible			Self-assessed performance
	Too high temperature	Stuffy air	Unpleasant odours	Uncomfortable seating	Too little space	No visual privacy	
Extraversion	-0.002	-0.057	0.058	-0.088	-0.021	-0.119	-0.021
Neuroticism	-0.073	0.059	-0.027	0.001	0.156**	0.237***	-0.209***
Openness to experience	-0.065	0.044	0.058	0.136*	0.229***	0.117	-0.208***
Conscientiousness	0.025	0.022	0.076	-0.046	0.049	-0.022	-0.097
Agreeableness	-0.060	-0.100	-0.162**	-0.179*	-0.018	-0.171**	0.123

*** $p < .01$, ** $p < .05$, * $p < .1$.

Table 4: Correlation of personality traits and participants perceived interference. Extracted from Franke & Nadler (2021)

3.5 Workplace noise levels on productivity, health and well being

Open-plan offices are noisier than their counterparts (Golmohammadi et al., 2021; Oseland & Hodsman, 2018). Increases in subjective fatigue and annoyance among office employees are shown when increasing levels of noise (Golmohammadi et al., 2021). Self-reported experience of loudness, subjective annoyance and overall Mental Workload (MWL) are all negatively affected in open-plan office types. Compared to a controlled quiet condition QC (N=31, 54db), working in an open-plan office (68db) resulted in higher degrees of annoyance ($r=1.590$), fatigue ($r=0.295$) and MWL ($r=0.500$). Attendants working in a closed office (64db) reported increased annoyance ($r=1.210$), fatigue ($r=0.203$) and MWL ($r=0.220$) compared to the Quiet Controll QC group but are less negatively affected than the attendants in the open-plan office setting. Another study found that 46.1% would prefer to work from home or elsewhere to get away from the noise, and 38.8% would work late to avoid noise distractions (Oseland & Hodsman, 2018).

Well-being ($\eta^2=0.02$), concentration ($\eta^2=0.02$), distraction ($\eta^2=0.03$) and speech ($\eta^2=0.09$) all have a significant relationship to workstation type when correcting for noise induced distraction (Oseland & Hodsman, 2018). When including other metrics, statistically significant correlations can be found in the relation between workplace environment and

productivity. Disturbance by noise, presented as acoustical quality, shows statistically significant correlations with disturbance by speech ($r=-0.32$), difficulties in concentration ($r=-0.35$), stress ($r=-0.24$), work engagement ($r=0.21$), and office productivity ($r=0.25$). A separate study found 22% of participants wanting to work in complete silence, 28% to work in slight white noise, 74% think that initial work should be done alone, and 12% said they wished to make the space less noisy (12%) (Needle & Mallia, 2021). By having employees get disturbed or distracted, productivity will be negatively affected as a consequence. Those spending more time in focus and concentration had a small but statistically significant effect by the noise metrics concentration ($\eta^2=0.02$) and distraction ($\eta^2=0.02$) (Oseland & Hodsman, 2018). Cognitively demanding tasks (-14.6%) are significantly more affected compared to simple office tasks that showed no statistically significant effects (Franke & Nadler, 2021).

Table 5:

Noise metric	Open (L, M, H)	Conscientious (L, M, H)	Extroversion (L, M, H)	Agreeable (L, M, H)	Neurotic (L, M, H)
Percentage performance	N/S	-7.2, -4.7, -4.6 ($p = 0.05, F = 4.4, \eta^2 = 0.02$)	-8.5, -4.3, -5.5 ($p = 0.01, F = 7.4, \eta^2 = 0.03$)	N/S	N/S
Ability to carry out work (5 = good)	N/S	3.6, 3.9, 3.8 ($p < 0.01, F = 4.8, \eta^2 = 0.02$)	N/S	N/S	4.1, 3.8, 3.7 ($p < 0.01, F = 5.3, \eta^2 = 0.02$)
Well-being (1 = good)	N/S	2.5, 2.1, 2.2 ($p < 0.05, F = 3.7, \eta^2 = 0.02$)	2.5, 2.1, 2.2 ($p < 0.05, F = 3.6, \eta^2 = 0.02$)	N/S	1.9, 2.2, 2.3 ($p < 0.05, F = 4.0, \eta^2 = 0.02$)
Stress (1 = good)	N/S	N/S	2.8, 2.5, 2.5 ($p < 0.05, F = 3.7, \eta^2 = 0.02$)	2.8, 2.5, 2.2 ($p < 0.05, F = 5.1, \eta^2 = 0.02$)	2.1, 2.6, 2.7 ($p < 0.001, F = 8.5, \eta^2 = 0.04$)
Productivity (1 = good)	N/S	3.1, 2.8, 2.7 ($p < 0.05, F = 4.4, \eta^2 = 0.01$)	3.1, 2.7, 3.0 ($p < 0.05, F = 3.9, \eta^2 = 0.02$)	N/S	2.5, 2.9, 3.0 ($p < 0.05, F = 4.1, \eta^2 = 0.02$)
Concentration index (1 = good)	N/S	2.9, 2.5, 2.4 ($p < 0.001, F = 9.9, \eta^2 = 0.04$)	2.8, 2.5, 2.5 ($p < 0.01, F = 5.1, \eta^2 = 0.02$)	2.7, 2.5, 2.3 ($p < 0.01, F = 5.0, \eta^2 = 0.02$)	2.2, 2.5, 2.9 ($p < 0.001, F = 20.6, \eta^2 = 0.08$)
Distraction index (1 = good)	N/S	2.7, 2.4, 2.6 ($p < 0.05, F = 3.7, \eta^2 = 0.02$)	N/S	N/S	2.4, 2.4, 2.8 ($p < 0.01, F = 6.2, \eta^2 = 0.03$)
Speech index (1 = good)	N/S	N/S	N/S	2.7, 2.7, 2.4 ($p < 0.05, F = 4.0, \eta^2 = 0.02$)	2.6, 2.7, 2.8 ($p < 0.05, F = 3.9, \eta^2 = 0.02$)

Table 5: Noise ratings for each personality trait. Extracted from Oseland & Hodsman (2018)

Other smaller effects were found when accounting for other predictors on productivity. Organization size had a small but statistically significant effect size (Oseland & Hodsman, 2018). Those in smaller organizations (1-14 people) rated their concentration ($\eta^2=0.02$) and speech interference ($\eta^2=0.06$) better than those in larger organizations. Those

working in senior management or acousticians rated the effect of noise distraction on their concentration ($\eta^2=0.04$) and stress ($\eta^2=0.05$) better than those working in project management, cost consulting or business development (Oseland & Hodsman, 2018).

3.6 Personality Traits on Productivity in the Workplace

Personality appears to play a large role in the productivity of employees when considering workplace environment. Employees high in openness measured with the TIPI-J, followed a similar trend when increasing days WFH (Arata & Kawakubo, 2023). Key differences were found when analyzing knowledge processing/creation, which were minimally but significantly affected (+0.6%, -0.5%). Higher comprehensive productivity was also associated with high openness (+6.1%) compared to individuals with low openness (+1.2%).

Employees high in neuroticism follow a similar trend. Statistically significant effects were found in the relationship between neuroticism and productivity. Individuals with low neuroticism (+6.5%) were associated with having higher comprehensive productivity than individuals with high neuroticism (+2.2%). Conscientiousness had a significant effect on increases in comprehensive productivity, with individuals high in conscientiousness (+6.3%) being more associated with increased comprehensive productivity compared to individuals with low conscientiousness (+0.2%).

A binomial logistic regression analysis was used on the relations of exp.b on knowledge creation (Arata & Kawakubo, 2023). It found a small negative yet statistically significant relationship between FWH and knowledge creation with an odds ratio of 0.47 ($\beta=-0.75$). Openness was found to have a statistically significant relation to knowledge creation, with an odds ratio of 3.64 ($\beta=1.29$). Overall, those with higher levels of openness show higher degrees of knowledge creation productivity when working from home. In terms of

self-rated performance, subjects with high levels of neuroticism or openness reported being more affected by intangible factors (privacy, ergonomics) than others (Franke & Nadler, 2021).

Focus measured over several occasions, also known as momentary focus, showed significant effects between increased productivity, extraversion and workstation type (Baranski et al., 2023). Specifically, there are differences when predicting momentary focus assessing for extraversion on bench seating vs cubicles ($\beta=-0.34$). Considering the subjective one-time survey assessment of global focus, no statistically significant interactions between global focus and any of the Big Five personality traits.

A statistically significant effect on increased momentary focus was found when assessing for workstation type and neuroticism (Baranski et al., 2023). Additional post hoc analyses revealed a statistically significant difference between neuroticism and momentary focus, specifically for individuals in cubicles and private offices (Baranski et al., 2023).

Among employees in the creative industry, extraversion does not appear to affect level of distraction (Needle & Mallia, 2021). A chi square analysis ($N=143$) on extroversion level and self-reported likelihood of getting distracted at work brought results that were not significant, therefore concluding that level of extroversion does not have a significant effect on ability to focus.

Neurotic workers appear to be slightly more affected by noise distraction than emotionally stable respondents (Oseland & Hodsmann, 2018). Ability to carry out work ($\eta^2=0.02$), well-being ($\eta^2=0.02$), stress ($\eta^2=0.04$), productivity ($\eta^2=0.02$), distraction ($\eta^2=0.03$) and speech interference ($\eta^2=0.02$) are all more affected in neurotic workers. The largest effect size is found for the concentration index ($\eta^2=0.08$). Neurotic ($\eta^2=0.02$) and less conscientious ($\eta^2=0.02$) people were more likely to miss a deadline due to noise distraction. A survey conducted in another study found personality to not have a correlation with rate of

distraction, with 76% of introverts and 60% of ambiverts/extroverts claiming this (Needle & Mallia, 2021).

More introverted respondents were affected by noise distractions more than extroverts (Roskams & Haynes, 2020). This had an impact on the productive performance of introverts in a negative manner compared to extroverts ($\eta^2=0.02$). No statistically significant effects were found on speech index, distraction or ability to carry out work. Small effect sizes were found between extraversion and increased productivity ($\beta=0.19$, $\eta^2=0.029$) (Roskams et al., 2019). Less conscientiousness people are slightly more affected by noise distraction (Oseland & Hodsman, 2018) compared to people high in conscientiousness, their ability to work ($\eta^2=0.02$), productivity ($\eta^2=0.01$), concentration ($\eta^2=0.04$) are all negatively affected.

Employees who perform individual work (low interactivity with colleagues) tend to rate the open plan office as having a more negative impact on their productivity (Roskams et al., 2019). Small significant effects are found between lower interactivity with colleagues and disturbance by speech ($\beta=-0.002$, $\eta^2=0.021$), difficulties in concentration ($\beta=-0.15$, $\eta^2=0.045$) and productivity ($\beta=0.05$, $\eta^2=0.017$). Medium-sized effects are found between higher interactivity and increased work engagement ($\beta=0.19$, $\eta^2=0.074$). Increased noise sensitivity as a trait among employees, appears to show the largest effects on increased disturbance by speech ($\beta=0.77$, $\eta^2=0.38$) and difficulties in concentration ($\beta=0.35$, $\eta^2=0.13$). Stress ($\beta=0.15$, $\eta^2=0.018$), and productivity ($\beta=-0.11$, $\eta^2=0.019$) also appear to be more affected among individuals with this trait. When exposed to smaller and more crowded work environment with a lack of partitions, workers high in neuroticism ($r= -0.209$), openness ($r= -0.208$) show a significant negative effect on self-assessed performance (Franke & Nadler, 2021). Extraversion, conscientiousness and agreeableness do not show this statistically significant correlation.

3.7 Personality Traits on Health and Well-Being in the Workplace

Health and well-being in the workplace are measured in different ways across the ten studies. When predicting well-being through a measurement of momentary happiness, the specific personality traits agreeableness, conscientiousness agreeableness, and openness were not affected by workstation type (Baranski et al., 2023). Extraversion however was affected by workstation type. There was also a statistically significant difference in one-time measured global happiness between extroverted workers working in bench seating versus private offices ($B=-0.47$). Assessing for employee happiness on a subjective one-time survey-based measurement, significant effects of personality traits on global happiness from workstation type are not found. The trait neuroticism is significantly more affected by noise induced parameters, showing an increase in variables such as subjective annoyance, fatigue, and MWL (Golmohammadi et al., 2021).

When assessing for the role of personality in the workplace on health, conscientiousness has a statistically significant effect on likelihood of disability retirement, with there being a lower risk for disability retirement in individual's high in conscientiousness (Nielsen et al., 2021). This result still remains after adjusting for length of follow-up period as a confounder. Stress ($\eta^2=0.02$) and well-being ($\eta^2=0.02$) are rated more poorly by introverts when exposed to noise distraction (Roskams & Haynes, 2020). This result follows a similar trend with the results presented in Oseland & Hodsman (2018).

When exposed to noise distraction, well-being is negatively affected across all personality traits. Furthermore, noise showed small yet statistically significant effects on the personality trait agreeableness (Oseland & Hodsman, 2018). Noise had negative impacts on stress ($\eta^2=0.02$), concentration ($\eta^2=0.02$), and speech interference ($\eta^2=0.02$) on those with lower levels of agreeableness. Levels of each personality trait showed significant weak

correlations with the ability to cope with noise; openness ($r=0.11$), conscientiousness ($r=0.21$), extraversion ($r=0.11$), agreeableness ($r=0.11$), and neuroticism ($r=-0.34$).

Table 6:

	Omnibus Workstation Type	Pairwise slope comparison (with Bonferroni-corrected p-value)		
		Bench seating vs cubicle	Bench seating vs Private office	Cubicle vs Private office
Focus				
ESM				
assessed				
main effect	$F = 1.40;$ $p = .0249$	$B = 1.60;$ $p = 1.00$	$B = 0.4.93;$ $p = .287$	$B = 3.33;$ $p = .876$
interaction				
E	$F = 3.48;$ $p = .033$	$B = -0.34;$ $p = .045$	$B = -0.01;$ $p = 1.00$	$B = 0.33;$ $p = .144$
A	$F = 0.43;$ $p = .650$	$B = 0.10;$ $p = 1.00$	$B = -0.13;$ $p = 1.00$	$B = -0.24;$ $p = 1.00$
C	$F = 2.10;$ $p = .126$	$B = -0.34;$ $p = .175$	$B = -0.33;$ $p = .410$	$B = 0.02;$ $p = 1.00$
N	$F = 3.19;$ $p = .044$	$B = 0.28;$ $p = 0.237$	$B = 0.43;$ $p = 0.062$	$B = 0.15;$ $p = 1.00$
O	$F = 3.92;$ $p = .022$	$B = -0.55;$ $p = .023$	$B = -0.32;$ $p = .345$	$B = 23;$ $p = .977$
One-time				
assessed				
main effect	$F = 6.55;$ $p = .002$	$B = 0.55;$ $p = 1.00$	$B = 18.38;$ $p = .002$	$B = 17.84;$ $p = .007$
interaction				
E	$F = 0.41;$ $p = .663$	$B = -0.08;$ $p = 1.00$	$B = -0.27;$ $p = 1.00$	$B = -0.18;$ $p = 1.00$
A	$F = 0.18;$ $p = .839$	$B = -0.23;$ $p = 1.00$	$B = -0.09;$ $p = 1.00$	$B = 0.13;$ $p = 1.00$
C	$F = 0.71;$ $p = .492$	$B = -0.36;$ $p = .858$	$B = 0.03;$ $p = 1.00$	$B = 0.39;$ $p = 1.00$
N	$F = 0.56;$ $p = .572$	$B = 0.28;$ $p = 0.996$	$B = 0.25;$ $p = 1.00$	$B = -0.03;$ $p = 1.00$
O	$F = 1.01;$ $p = .367$	$B = 0.14;$ $p = 1.00$	$B = -0.45;$ $p = .710$	$B = -0.60;$ $p = .561$

Table 6 (continued)

Happiness				
ESM				
assessed				
main effect	$F = 1.61;$ $p = .202$	$B = 0.55;$ $p = 1.00$	$B = -5.62;$ $p = .325$	$B = -6.17;$ $p = .307$
interaction				
E	$F = 3.16;$ $p = .045$	$B = -0.09;$ $p = 1.00$	$B = -0.47;$ $p = .043$	$B = -0.38;$ $p = .177$
A	$F = 1.58;$ $p = .209$	$B = 0.04;$ $p = 1.00$	$B = -0.45;$ $p = .307$	$B = -0.49;$ $p = .352$
C	$F = 0.95;$ $p = .388$	$B = -0.22;$ $p = .993$	$B = -0.35;$ $p = .598$	$B = -0.13;$ $p = 1.00$
N	$F = 2.81;$ $p = .063$	$B = 0.03;$ $p = 1.00$	$B = 0.50;$ $p = .076$	$B = -0.47;$ $p = .135$
O	$F = 1.71;$ $p = .183$	$B = -0.41;$ $p = .300$	$B = 0.06;$ $p = 1.00$	$B = 0.47;$ $p = .309$
One-time				
assessed				
main effect	$F = 0.48;$ $p = .62$	$B = -2.02;$ $p = 1.00$	$B = 2.15;$ $p = 1.00$	$B = 4.16;$ $p = .990$
interaction				
E	$F = 0.97;$ $p = .380$	$B = -0.16;$ $p = 1.00$	$B = -0.29;$ $p = .535$	$B = -0.13;$ $p = 1.00$
A	$F = 0.67;$ $p = .514$	$B = -0.07;$ $p = 1.00$	$B = -0.35;$ $p = .751$	$B = -0.28;$ $p = 1.00$
C	$F = 2.87;$ $p = .060$	$B = -0.41;$ $p = .292$	$B = -0.67;$ $p = .080$	$B = -0.26;$ $p = 1.00$
N	$F = 0.68;$ $p = .509$	$B = -0.09;$ $p = 1.00$	$B = 0.23;$ $p = 1.00$	$B = 0.32;$ $p = .742$
O	$F = 2.78;$ $p = .065$	$B = -0.65;$ $p = .060$	$B = -0.15;$ $p = 1.00$	$B = 0.50;$ $p = .385$

Table 6: The Significance of The Main Effect of Workstation Type and Interaction of Workstation Type and Personality Trait in Predicting ESM (Experience sampling methodology) and Survey-Assessed Focus and Happiness. Extracted from Baranski et al., (2023).

Table 7:

Variable	Step 1 (N=6778) ^a		Step 2 (N=5498) ^b		Step 3 (N=5106) ^c		Step 4 (N=5106) ^d	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Office design								
Cellular (reference)								
Shared	1.86	1.38-2.50	1.46	1.06-2.01	1.57	1.11-2.21	1.58	1.18-2.22
Open-plan	1.87	1.31-2.67	1.75	1.20-2.54	1.92	1.30-2.86	1.93	1.30-2.87
Work ability			0.79	0.75-0.84	0.79	0.75-0.84	0.79	0.74-0.84
Days with sickness absence 12 months prior to survey								
0 (reference)								
1-7			1.13	0.67-1.89	1.17	0.67-2.01	1.17	0.69-2.00
8-14			1.24	0.70-2.22	1.42	0.80-2.55	1.41	0.78-2.54
15-21			0.68	0.28-1.68	0.83	0.34-2.06	0.82	0.33-2.02
22-28			0.54	0.13-2.21	0.59	0.14-2.41	0.60	0.15-2.46
>28			2.41	1.73-3.36	2.33	1.62-3.35	2.36	1.64-3.38
Gender								
Males (reference)			2.49	1.79-3.46	2.21	1.55-3.16	2.21	1.55-3.15
ISCO skill level								
1 (reference)								
2			1.36	0.98-1.89	1.26	0.88-1.79	1.12	0.77-1.63
3			1.21	0.82-1.76	1.18	0.79-1.78	1.12	0.74-1.70
4			1.64	0.50-5.36	1.35	0.32-5.57	1.13	0.27-4.83
5			0.77	0.41-1.45	0.69	0.35-1.36	0.69	0.35-1.35
Leadership responsibility			1.04	0.69-1.57	1.04	0.68-1.60	1.05	0.68-1.11
Extroversion					1.02	0.91-1.14	1.02	0.91-1.15
Conscientiousness					0.85	0.73-0.98	0.85	0.73-0.99
Agreeableness					1.13	0.95-1.34	1.12	0.96-1.36
Openness					1.06	0.91-1.24	1.06	0.94-1.33
Neuroticism					1.13	0.99-1.27	1.12	0.99-1.27
Length of follow-up period							1.06	0.99-1.12

^a Step 1. Crude, unadjusted, model.

^b Step 2. Adjusted for work ability, sickness absence 12 months prior to survey, gender, skill-level, and leadership position

^c Step 3. Personality traits added as additional confounders

^d Step 4. Length of follow-up period added as additional confounder.

Table 7. Associations between office designs and registry-based disability retirement (Cox Regressions; N=6779). [HR=Hazard Ratio; CI=Confidence Interval; ISCO=International Classification of Occupation]. Extracted from Nielsen et al., (2021).

3.8 Personality Traits on Preference for Workplace Environment

Several studies show clear statistically significant correlations between personality traits and preferences in workplace environment. These preferences are both tangible (physical) and intangible (psychological). One of the intangible preferences employees have for their workplace environment is a need for privacy (Franke & Nadler, 2021). Feeling a lack of privacy in the workplace environment showed significant correlations on workers high in neuroticism ($r=0.237$) and agreeableness ($r= -0.171$). This result goes along with similar findings in Roskams & Haynes (2020). In this study, higher introversion ($\beta=-0.12$) is related to a higher need for workspace segregation. A survey conducted on employees working in the creative industry found 47% of introverts wanted more private space (Needle

& Mallia, 2021). A Spearman's rho correlation was used to detect any significant effects of population personality traits on user satisfaction with privacy (Hartog et al., 2018). Results shows that extraversion was the only personality trait to have a significant effect on user satisfaction with privacy ($\rho=0.111$). This correlation goes along with a survey conducted regarding the preference of workplace environment of creative workers (Needle & Mallia, 2021). A large portion (76%) of all employees in the study longed for a more private and flexible workplace environment.

In terms of tangible preferences, table 7 extracted from Hartog et al., (2018) shows there are statistically significant effects found between personality traits and user satisfaction with physical characteristics. There are statistically significant relationships between personality traits and user satisfaction with accessibility by car, office exterior and division, washroom facilities, fixed workspaces, adaptability furniture, and total user satisfaction with physical characteristics. When conducting a multiple regression analysis with personality traits as the only independent variable, smaller effect sizes are found compared to an analysis includes other demographic variables such as age and gender (Hartog et al, 2018). In this second model, the relationship between user satisfaction and personality traits includes demographic characteristics as an independent variable. Assessing individual personality traits and their preferences in physical work environment, significant correlations were found (Hartog et al, 2018). Only extraversion, agreeableness and openness showed statistically significant results. In terms of user satisfaction with workstation type (fixed, flexible), and only agreeableness had a statistically significant effect on either type, both being positive with the stronger significance towards fixed workspaces. No other personality trait had any significant effects on user satisfaction with fixed or flexible workstation types (Hartog et al., 2018).

Other demographic variables appear to demonstrate significant preferences (Roskams & Haynes, 2020). Preferences for higher workplace segregation were associated with being male ($\beta=-0.14$) and being more susceptible for distraction ($B=0.38$). Preferences regarding working in a fixed or flexible workplace was shown in another model regarding workplace territoriality. Preferring to work in a fixed workplace environment was associated with being female ($\beta=0.1$), lower task heterogeneity ($\beta=-0.1$, $p<.001$), and higher susceptibility to distraction ($\beta=0.14$) (Roskams & Haynes, 2020). Employees completing repetitive and procedural work of low heterogeneity appear to not need a variety of different workspaces.

Table 8:

User satisfaction with ...	Model I (five personality traits as independent variables)			Model II (five personality traits and demographic characteristics as independent variables)		
	Adjusted R^2	F	N	Adjusted R^2	F	N
Accessibility by car	0.031*	2.090	173	0.099**	2.356	173
Accessibility by public transport	0.012	1.406	169	0.160**	3.138	169
Office exterior and division	0.024*	1.899	181	0.180**	3.478	181
Office decor	0.013	1.531	179	0.126**	2.616	179
Seclusion rooms	0.022	1.632	138	0.156**	3.325	138
Entrée and atrium areas	-0.011	0.620	174	0.056*	1.686	174
Washroom facilities	0.037**	2.429	183	0.121**	3.291	183
Flexible workspaces	0.027	1.859	156	0.165**	3.374	156
Fixed workspaces	0.084**	3.811	153	0.123**	3.386	153
Adaptability furniture	0.048**	2.441	142	0.110**	2.959	142
Personal control indoor climate	-0.001	0.953	171	0.074**	1.975	171
Information and communication technology and equipment	-0.018	0.454	152	0.008	1.099	152
Office climate	-0.016	0.415	181	0.100**	2.263	181
Total user satisfaction with physical characteristics	0.027*	2.016	183	0.152**	3.739	183

Note: *Significance at the 90% confidence level; **significance at the 95% confidence level.

Table 8: Specification of the fourteen multiple regression analyses of Hartog et al., (2018). User satisfaction with different physical characteristics of multi-tenant offices.

Discussion

The aim of this discussion is to analyze the effects of workplace environment and personality traits on subjective productivity, health and well-being. Overall, a large number of studies found the relation between productivity and workplace environment to be statistically

significant. This goes along with previous research regarding the effect that workplaces have on employee productivity (James et al., 2021). However, the way in which productivity was measured varies greatly among the different studies. There is a general lack of objective measurement of productivity in the literature reviewed. All ten studies used subjective self-report surveys to determine level of productivity. Two of the studies included used objective measurements (Franke & Nadler, 2021; Nielsen et al., 2021), of which only one measured productivity objectively (Franke & Nadler, 2020). The use of subjective self-reporting to measure productivity is potentially confounded due to the effects of third-party variables such as culture or personality traits (Paulhus & Vazire, 2007; Costa & McCrae, 1980), and is further discussed in the limitations section of this review. The lack of objective measurement challenges the instrumental validity of the results presented regarding productivity. This also goes for when and how often the measurements of productivity were conducted. In studies where focus was measured several times instead of in one-time surveys, different results were reported. There were more statistically significant effects when measuring focus on multiple different occasions (momentary focus), compared to measurements on the one-time self-report survey, also known as global focus (Baranski et al., 2023). The confounding variables of this difference in results could be of great interest for future research on the subject.

In terms of personality, there were several interesting results regarding the relation between neuroticism and several factors in workplace environment and subjective outcome variables. Individuals low in neuroticism were found to have higher levels of simple task productivity both when working from home (Arata & Kawakubo, 2023) compared to working in an open office (Baranski et al., 2023). This association could be affected by the tendency for individuals high in neuroticism to self-handicap more often compared to their counterparts. Increased levels of self-handicapping are associated with higher levels of procrastination (Ferrari & Tice, 2000), thus possibly affecting their lower self-reported

performance. Their lower levels of emotional stability and general tendency to rate their subjective well-being lower than extraverted workers, could account for some of the differences in scores when looking at the results on this outcome variable. Stress, distraction by noise, subjective well-being and even productivity presented statistically significant negative results in neurotic workers (Oseland & Hodsman, 2018).

Workers high in neuroticism showed a significant negative effect on self-assessed performance (Franke & Nadler, 2021). This effect is reflected in the general behavioral tendency of neurotic workers and could be correlated to some of the negative effects related to more neurotic workers. The results presented in Oseland & Hodsman (2018), show that neurotic workers are less able to cope with noise. This could possibly contribute to why neurotic workers tend to rate higher subjective fatigue higher than others (Costa & McCrae, 1980). This argument is further enhanced as Golmohammadi et al., (2021) found similar results. Therefore, quieter and more private workplace environments may be more beneficial for neurotic workers accounting for productivity, health as well as well-being. However, seeing as most of the instruments used to measure productivity were based on self-report surveys, neurotic workers might appear to be more negatively affected than they truly are. The results presented in Golmohammadi et al., (2021) should also be interpreted cautiously, seeing as the sample used in the study only consisted of male participants.

In terms of momentary as well as global happiness, extraversion was the only personality trait to show higher levels of happiness across different workplace environments (Baranski et al., 2023). The general tendency for extraverted workers to rate their well-being higher than others might play a part in these results. The social aspect of extraverted individuals could also affect why extraverted employees were more negatively affected having to work in cubicles instead of open-bench seating (Baranski et al., 2023). Results presented on introverted employees further support this argument. Introverted workers

reported being more negatively affected in productivity when working in open-plan offices (Roskams et al., 2019). In fact, the increase of social interactivity with other colleagues showed medium effect sizes on increased work engagement (Roskams et al., 2019). When assessing for creative and social forms productivity, working from home presented a negative but not statistically significant effect on extraverted workers (Arata & Kawakubo, 2023). The social characteristic of extroverted workers might be an affecting variable in this relation, but further research is needed to draw any meaningful conclusion on this matter. Neuroticism presented a significantly positive effect on increases in productivity by increasing rate of FWH. Giving extraverted workers a social work arena and the opportunity to work with others in a more open setting, could be more beneficial for both the individual and the organization. Additionally, giving introverted workers the option of working amongst themselves either through private offices or increasing FWH may be of benefit.

Furthermore, the hard-working trait conscientiousness presented the least negative effects on subjective well-being and productivity in different work environments. This trend is visible both when WFH (Arata & Kawakubo, 2023) and working in an open or closed office (Baranski et al., 2023). No significant preferences in physical characteristics of workplace environment on user satisfaction were found for workers high in conscientiousness (Hartog et al., 2018). The reliable aspect of this personality trait could be an explanatory variable for why they appear to be affected by many of the effects affecting their counterparts. Their ability to work prevails across different office types. Furthermore, when comparing the rate of distraction on noise between conscientious and neurotic workers (Oseland & Hodsman, 2018), workers high in conscientiousness were far less affected by noise distractions than their colleagues. Higher levels of conscientiousness were also the only trait to be significantly less at risk for disability retirement (Nielsen et al., 2021). The long-term effect of this could be of great interest for future research. Productivity wise, less

conscientious people were less likely to miss a deadline due to noise distractions than neurotic workers (Oseland & Hodsman, 2018) These results could be attributed to their hard-working and reliable attitude and being able to keep their heads down and keep working despite not being fully satisfied with their environment. However, caution must still be applied when drawing any conclusions due to the self-report nature of many of these statistics.

Despite the trait openness being more creative and open to new experiences, they rate themselves poorly on subjective self-assessed performance similarly to their neurotic colleagues. Their tendency to be more intellectually creative and curious might play a part in the overall increase creative productivity measured in knowledge creation (Arata & Kawakubo, 2023). When designing work environments, workers high in neuroticism and openness may be considered similarly in terms of architectural design, seeing as both traits are more negatively affected than others when removing privacy (Franke & Nadler, 2021). The openness traits' tendency to be open to new experiences could possibly affect the degree of which the office type they work in affects their happiness, in a similar manner to individuals high in conscientiousness. However, happiness does not appear to be affected in workers high in openness when accounting for workstation type (Baranski et al., 2023).

As mentioned previously, the Big Five is a well-established and reliable instrument when using the English language for its trait adjectives (Goldberg, 1981). When comparing results between personality traits when WFH and in an office, there is an instrumental difference between the personality inventory used by Arata & Kawakubo (2023) and the other nine studies included in this review. Oshio et al., (2013) researched the convergent validity of the TIPI-J compared to other English personality-inventories. They presented the following convergent correlations between the TIPI-J and the Big Five dimensions; extraversion ($r=0.65$), agreeableness ($r=0.49$), conscientiousness ($r=0.63$), neuroticism ($r=0.70$), ad

openness ($r=0.46$). There is concern regarding whether the two items per dimension in the TIPI-J are able to encapsulate the full breadth of the Big Five dimensions. However, the TIPI-J presents content validity on-par with its English counterparts. Convergent correlations between other English inventories show correlations between $r=0.56-0.68$ (Gosling et al., 2003), and $r=0.41-0.76$ (Muck et al., 2007). This high level of content validity therefore makes results presented in the TIPI-J valid for comparison with the other studies included in this review.

4.1 Limitations

Due to the lack of objective measurements of productivity, a generalization on the effect that workplace environment and personality traits has on productivity is difficult to assess and compare. This limitation regards the validity of the instruments involved in the studies included in this review. Limited results were presented to support this relationship. Only a singular measurement of productivity presented used objective instruments (Franke & Nadler, 2021). This study was conducted in a laboratory setting, which decreases the risk of specific confounding variables. However, the small sample size ($N=33$) and homogenic sample of male participants (100%) affects its external validity. The effect of a social work-environment has been shown to have an effect on employee productivity (Lindeberg et al., 2022), and the lack of correcting for this variable could be a limitation. In terms of sampling method, a majority of the studies were conducted using different convenience sampling methods. This form of biased sampling method could therefore further affect their external validity.

Limitations are also found regarding the review process. Firstly, language bias is an immediate limiting factor. Litterature posted in languages other than English have not been included, possibly affecting the generalization of results presented in this review.

Furthermore, due to time constraints there has not been utilized more than one single database, limiting the amount of articles screened and reviewed. Due to the heterogeneity of methodology and instruments used to measure personality and outcome variables, it is also difficult to synthesize findings and draw meaningful conclusions. Finally, several contextual factors such as organizational policies, socioeconomic status and cultural differences have not been accounted in the synthesis of data in this review.

4.2 Future Research

Due to the lack of studies using an objective measurements of productivity on office employees, future research should therefore attempt to endeavor into this aspect. The relation between self-reports and behavior such as productivity is modest (Meyer et al., 2001), which further emphasizes the need for objective measurement, specifically on office workers.

Furthermore, research looking at the specific differences in results comparing productivity in office workers and laboratory respondents can be of interest. Finally, the long-term effects of increased noise distraction and subjective fatigue may lead to effects on a given organization, meaning a longitudinal study on their effects on employees could be of great benefit.

Research on this subject could promote new organizational interventions aiming to decrease these negative effects.

Furthermore, studies included in this review vary in their way of analyzing degrees of productivity and well-being. Most studies analyzed the effect of personality and the effect of workplace environment factors separately. Therefore, future research could aim address this gap in research by aiming to analyze whether the effect of workplace environment gets more nuanced when also including personality traits as a factor. Seeing as neurotic workers were more affected by many of the negative effects presented in open-plan environments, further research could look into what other effects neurotic workers are more prone to be affected by

in these environments. Arata & Kawakubo (2023) found a difference in improvement of productivity amongst workers in different occupations when increasing FWH. Specifically, workers doing clerical work were rating higher productivity compared to sales. Similar effects were also presented in Roskams & Haynes (2020), as demographic variables such as being female and lower task heterogeneity was associated with preferring to worked in a fixed and more private work environment such as working from home. The difference in rate of extraverted and introverted workers in these different occupations, is not enlisted in the study and could be of interest to see whether or not it has an effect on this relationship. Differences in other demographic variables on the nuance of this specific relation could be an exciting hypothesis to further study. Research shows that there appears to be a curvilinear relationship between degree of extraversion and sales performance (Grant, 2013). Therefore, future research could also look at whether the degree of FWH affects degrees of extraversion differently.

Conclusion

This review has attempted to look at the effect of workplace environment and personality on productivity, health and well-being. There appears to be a general gap in research objectively measuring the direct effects of both workplace environmental factors and personality on productivity, health and well-being. In terms of preference, there seems to be a general favorability for employees to work in fixed-private work environments. This goes along with findings presented in previous research on the subject (James et al., 2021; Bodin & Bodin Danielsson, 2008). This favorability for fixed-private work environments spans across personality traits, primarily due to the lower noise levels and levels of distractions found in these office types. Personality presents mixed effects on subjective happiness, health, and well-being. Preference in work environment also presented small but significant correlations

with personality traits but were however more influenced by other demographic variables such as age and gender. Neurotic workers were more affected by noise and distractions in open-plan offices, affecting their productivity and well-being. Extraverted workers were more negatively affected than their colleagues in creative productivity when having to work more from home more often, and when having to work in more closed work environments. Finally, an increase in productivity was found when increasing FWH for certain occupations such as clerical work. The effects of increasing FWH on different occupations is therefore of large interest for future research.

Subjective fatigue, health and objective well-being were all negatively affected when working in an open plan office across all personality traits, with conscientiousness being the least affected in terms of health. Due to the increased risk for disability retirement and lower job satisfaction associated with open-plan offices, considerations for personality traits should be made to combat its negative effects. By considering these factors when designing an office landscape, positive effects can be presented on several areas of employee health and well-being. These effects could present long-term benefits for the employee as well as the organization.

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