

Does personality matter? Extraversion as a predictor for well-being and functioning in the open-plan office

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Abstract: Researchers have discovered relationships between workplace design and the well-being and performance of occupants, and by aligning workspace conditions and the personality of employees this current study adds to the literature on person-environmental associations. The aim of this review was to investigate whether extraversion was associated with differences in work performance and well-being of employees working in open-plan offices by asking how open-plan offices affect employees who are extraverted compared with those who are introverted. Based on the current literature, eleven studies were identified to create four key dimensions to guide the understanding regarding this topic: (1) Well-being, (2) Performance, (3) Interpersonal job context, and (4) Noise Management. This review found that extraverted individuals seem to benefit more from working in open-plan offices than introverts, especially regarding productivity. Noise induced by this kind of office environment also seems to have a greater negative effect on introverts, and extraverts appeared to be happier in the open-plan office environment compared with introverts. This study gives a brief insight into the effect of workplace environment on occupants and highlights some of its own methodological weaknesses that should be accounted for in future research.

Abstrakt: Forskere har avdekket forhold mellom måten en arbeidsplass er utformet på og velværet og yte-evnen til de ansatte, og ved å sette forholdene ved en arbeidsplass opp mot personligheten til de ansatte bidrar denne studien med informasjon til litteraturen som ser på påvirkningsforholdet mellom person og miljø. Målet med studien var å undersøke om ekstrovertitet var assosiert med ulikheter i ytelse og velværet til ansatte som jobber i åpne kontorlandskap og gjorde dette ved å spørre hvordan åpne kontorlandskap påvirker ekstroverte ansatte sammenliknet med introverte. Basert på dagens litteratur ble elleve studier identifisert og disse lagde fire hovedtemaer som alle tilfører informasjon til tematikken: (1) Velvære, (2) Prestasjon, (3) Mellommenneskelig jobbkontekst, og (4) Støy Håndtering. Denne litteraturstudien fant at ekstroverte individer synes å dra mer fordel av å jobbe i åpne kontorlandskap enn introverte, særlig når det gjelder produktivitet. Støy med kilde i denne typen kontorlandskap synes også å påvirke introverte mer negativt, og ekstroverte synes å være lykkeligere i åpne kontorlandskap sammenliknet med introverte. Denne studien gir kort innsikt i effekten utforming av arbeidsplassen har på de ansatte og fremhever noen svakheter i forbindelse med egen metodologi som bør tas høyde for i senere studier.

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1. Introduction:

An open-plan office is defined by the absence of floor-to-ceiling walls where employees share a common workspace that is supposed to stimulate collaboration (Bell et al., 2001; Needle & Mallia, 2020). However, concerns have been raised that there might be a considerable interaction effect between personality traits and employees' such that creating successful workplaces requires understanding the needs, capacity, and behavior of the occupying people and organizations (Cain, 2012; Oseland, 2009). Studies have shown that certain personality traits are associated with work performance and job satisfaction and that modern-day workplaces in general tie employees both psychologically and physically to accommodate extroverts (Doessy, 2016; Seddigh et al., 2016). This is partly because the workplace has seen a shift toward a reduction in square footage per employee, leading employees to work in bigger, shared offices where noise distractions and personal space are providing significant challenges (Appel-Meulenbroek et al., 2020; Baranski et al., 2023; Bos et al., 2017). Thus, the aim of this review was to investigate the following topic: *Do different office layouts suit employees differently based on their personalities?*

1.1. The open-plan office:

The term open-plan office has no standard definition, but it generally describes various office types employing large open spaces where workers share a common workspace executed in a variety of configurations (hives, long tables, booths, etc.), and is primarily characterized by the absence of floor-to-ceiling walls although limited partitions between employees can be found (Bell et al., 2001; Danielsson & Bodin, 2008; Needle & Mallia, 2020). Because of its cost-effectiveness, flexibility and ability to facilitate communication this kind of office has been popular among professionals since the late 1960's. The fact that this design tends to produce higher occupant density than what is typically found in traditional enclosed offices is a factor affecting the environmental satisfaction among employees working in open-plan offices (Duval et al., 2002).

In fact, studies have noted a deterioration of the physical health of employees moving to open-plan offices as well as it has been observed a significant decrease in perceived performance among employees relocating from individual offices to open-plan offices (Bergström et al., 2015; Shafaghat et al., 2014). A study by Pejtersen et al. (2011) revealed

that the sickness absence for Danish employees working in open-plan offices was considerably higher than for those working in cellular offices. They also found a statistically significant relationship between sickness absence and the number of occupants in the office. Transitioning from individual to open-plan working has also been associated with a significant decrease in employee satisfaction and perceived job performance (Brennan et al., 2002). The same study also found that this office layout was associated with an increase in stress with the primary concerns of occupants being increased noise, lack of privacy and confidentiality. Despite this, good technical design and thoughtful ergonomic assessment of employees' needs and their tasks' requirements have been shown to yield positive outcomes relating to collegiality and communication in open-plan offices (Khazanchi et al., 2018; Morrison and Smolland, 2020).

1.2. Assessing personality:

Our personality defines our requirements and preferences for our physical environment and influence how it is perceived (Marzban et al., 2021). This illustrates a need for workplaces to accommodate the need of employees in order to optimize their abilities. Larsen et al. (2021) define personality as “the set of psychological traits and mechanisms within the individual that are organized and relatively enduring and that influence his or her interactions with, and adaptations to, the intrapsychic, physical and social environments” (p. 3). The taxonomy of personality traits that has received the most attention and support from personality researchers has been the five-factor model, also known as Big Five (Larsen et al., 2021). The traits composing this model have been named *Extraversion*, *Agreeableness*, *Conscientiousness*, *Emotionally Stability* and *Openness*. The Big Five has been extensively utilized in both organizational and other applied research with extraversion being one of the most studied personality traits used to understand workplace outcomes (Blevins et al., 2022; Bozionelos, 2003; Seddigh et al., 2016),

The cardinal feature of the trait *Extraversion* is said to be social attention and this personality dimension is measuring the intensity level of interpersonal interactions, activity level, and need for stimuli and can be interpreted as the dimension of active engagement with social endeavors. People scoring high on extraversion have a greater tendency to engage and enjoy social attention and therefore also often have a greater impact on their social environment compared with those scoring lower on the scale (i.e introverts) (Ashton et al., 2002). The general tendency is that the need for stimuli, activity level, and intensity level of

interpersonal interactions are rated higher in extraverted individuals compared with introverts, who are people predominantly characterized by being more reserved, having fewer social contacts, and having less need for external stimuli (Kaufmann & Kaufmann, 2020).

1.3. Theorizing the relationship between personality and workplace:

In an attempt to explain the mechanisms behind the relationships between personality and job performance, the interactionist model of behavior frames occupants' behavior as a result of the interplay between the situation and the personality of employees (Baranski et al., 2023). Furthermore, these researchers demonstrated that specific features of the office environment interact positively and negatively with the employee based on their specific personality features.

As a part of this theory, person-environment fit (hereafter referred to as P-E fit) refers to the interplay between characteristics of the individual and their environment whereby individuals both affects and are affected by their environment (Wolraich et al., 2007). P-E fit is defined by the congruence between person and environment, and among the various types of P-E fits, person-organization (P-O) and person-job fit (P-J) have been most extensively studied (Sekiguchi, 2004). While P-J fit refers to the match between the abilities/desires of an employee and the demands/attributes of a job, P-O refers to the compatibility between a person and the organization where he or she works, thus emphasizing the extent to which the person and organization can meet each other's needs and/or share similar characteristics (Edwards, 1991; Kristof, 1996). A study by Gardner et al. (2012) found that extraversion was positively related to subjective P-O fit for clan culture, suggesting that highly extravert employees would most likely be more attracted to team-oriented cultures than low extraverts. A third operationalization of P-O fit is personality-based job fit, which refers to the degree to which an employee's elevations on personality traits relevant to the job are consistent with the tasks and social levels comprising the specific job (Christiansen et al., 2014; Sekiguchi, 2004). Employees with higher elevations on extraversion are thought to be more comfortable performing interpersonal work tasks compared with those scoring lower on the trait, as well as high extraverts most likely would thrive in active workplaces cultivating social connections and communication among employees (Wilmot et al., 2019).

Previous meta-analyses have shown a substantial variance in the relationship between personality and performance that remains unaccounted (e.g. Barrick et al., 2001; Hertz and

Donvan, 2000). This may be an indicator that other variables regarding individual differences, or external conditions, moderate the relationship between personality and performance. Self-monitoring has been one variable that has been conceptualized as a potential moderator for the mentioned relationship (Barrick et al., 2005; Gangestad & Snyder, 2000).

Self-monitoring theory proposes that individuals' willingness and ability to monitor and control their behaviors and public appearances systematically vary, and whilst high self-monitors have a strong desire to project positive images of themselves, low self-monitors are less concerned with status and adapting to others but are more interested in self-validation (Fuglestad & Snyder, 2009; Gangestad & Snyder, 2000; Kaufmann & Kaufmann, 2020). People high in self-monitoring are better at communicating and solving conflicts through collaboration with employees than those low in self-monitoring, who often are more competitive, straightforward and negative in their communication (Kaufmann & Kaufmann, 2020). Gohar et al. (2016) and Morrison (1997) investigated associations between personality and self-monitoring and made findings indicating a positive relationship between self-monitoring and extraversion. This relationship may help facilitate social relationships and hence contribute to well-being among extraverted employees (Pillow et al., 2017).

1.4. Extraverts in the office:

Exactly how personality traits affect the relationships between workstation type and job satisfaction and performance is not yet fully understood which was why Judge et al. (2002) investigated the association between Big Five personality dimensions and job satisfaction. The study demonstrated that high levels of conscientiousness and extraversion were found to be related to higher levels of job satisfaction. Studies have also found that people high on neuroticism systematically report lower levels of job satisfaction (Baranski et al., 2023). However, the main effect of extraversion on job satisfaction does not take P-J fit into account, and based on the notion of this model, extraverts may be more satisfied in jobs with high interpersonal context (Huang et al., 2015). This is opposed to introverts, who often are most comfortable being on their own as alone time allows them to re-energize (Dossey, 2016). Doessy (2016) noted that introverts' need for solitude and space is not favored by our modern-day society. By moving in a direction where workspaces are based on promoting frequency of interactions among occupants, it becomes apparent that introverts to some extent may be forced to work in environments that do not necessarily fit their needs and desires as good as they fit the ones of extraverts (Vitasovich et al., 2016).

As different work-space layouts carry with them different levels of privacy, noise conditions, social traffic and distractions, personality differences may play an important role in determining how particular work-space arrangements affect their performance and well-being (Lindberg et al. 2016). Compared with introverts, extraverted individuals tend to be more social and actively seeking within their environment, which may be characteristics explaining why research has found that they have a greater tolerance and are more satisfied than their counterparts when it comes to sound privacy within space (Cheung et al., 2022). For instance, Oseland (2009) proposed that noisy and active work environments may improve the performance of extraverted people, whereas more calming work environments possibly have a more positive effect on the performance of introverts. Since it has been suggested that open office layouts generate distraction due to increased noise levels compared with traditional offices, it is likely to assume that extroverts will be more satisfied in this kind of office environment than introverts (Otterbring et al., 2020). However, a study by Cassidy and Macdonald (2007) showed that the performance of both introverts and extraverts was lessened in the presence of background sound (music) compared to silence. Hence, the researchers could not fully support the prediction that extraverts' performance would be less negatively affected by sound than introverts. Gheewalla et al. (2021) made a similar discovery when they investigated the effect of background noise on reading comprehension performance and found a significant main effect of background sound with poorer performance in the presence of distraction. However, the researchers could not find that this interaction was modified by extraversion.

Chu et al. (2015) found that extraversion is a protective factor for the physiological health of occupants in consideration of both work stress and social stress. Extraversion has also appeared to be a predictor of burnout and has been associated with less burnout among employees during covid-19 (Bakker et al., 2006; Moon et al., 2023). The authors have proposed that this effect may be due to extraverted employees being better able to adapt to social changes in their environments whereas introverts are less suited to do so and therefore chose to escape their stressful environments. Rodgers and Barber (2019) sought to investigate whether workplace intrusions were positively associated with strain outcomes for introverts. This study found that workplace intrusions were negatively associated with stress for introverts while they could not find an association between intrusions and stress for extraverts. However, they found that intrusions were related to emotional exhaustion under conditions of heavy workload for extraverts.

These findings illustrate the fact that research is inconclusive on the topic of how people are affected by their environment and extravert personality. Within the last decades, cellular offices have been more and more replaced with open-plan offices, which marks a transition moving from fixed workplaces valuing privacy, to shared ones (de Croon, 2005; Pejtersen, 2006). Knowing that introverts value privacy more while extraverts have a greater preference for stimulating environments creates grounds for believing that modern-day office structure favors the well-being and work abilities of extraverts while neglecting the needs of introverts (Seddigh, 2015). Despite this, the literature on the topic still has important gaps which accentuate the need for an assessment of how open-plan office spaces suit and affect employees based on their extravert personalities (Blevins et al., 2022; Harari et al., 2018; Seddigh et al., 2016).

2. Method:

2.1. Aims of the review:

This literature review aimed to investigate the relationship between office layout and employees' personality by looking at how employees' well-being and productivity are affected by their extraversion score in the open plan office concept. The main task was to uncover some characterizing factors with the open-plan office and both directly and indirectly examine their impact on employees' function and well-being. With this aim in mind, the review sought to address the question:

How do open plan-office settings affect extraverted employees compared with introverts?

Negative associations were anticipated between open-plan office and introverted employees' measurements of well-being, productivity and ability to carry out work. Opposite, positive associations on these measures were anticipated between extrovert employees working in open-plan office.

Only a small amount of existing research has linked personality to workspace characteristics and findings are yet not to be consistent (Baranski et al., 2023; James et al., 2021). Because of this, a systematic literature review was chosen as the research method given its capacity to summarize current knowledge within specific domains by only selecting

papers that satisfy a set of criteria (Oxman, 1994; Watts & Robertson, 2011). A systematic literature review is by this intended to avoid bias and yield as transparent and objective results and conclusions as possible (Linde & Willich, 2003).

2.2. Search strategy:

Each search was performed on the article title, abstract and keywords, and the keywords *personality, open-plan office, introvert, extroversion/extraversion, job satisfaction* and *shared office* were combined in multiple ways when searching in the following databases: *PsychINFO, PubMed* and *Scopus*. The search was conducted by combining person-variable (personality, extraversion, employee) and an environmental-variable (Open-plan, noise, distraction, office). Since *extrovert* is the usual spelling while *extravert* is primarily seen in psychological writing, both versions of the term were used in the search process to capture as many articles concerning the theme as possible (O’Conner & Kellerman, 2016). *Personality* was used in order to expand the search to articles that did not include extraversion in the title, abstract, or keywords, but may have mentioned anything about this in other parts of the text. To start with, terms were chosen to limit the retrieved articles to studies specifically focusing on how employees’ well-being is affected by their extravert personalities in open-plan offices. Solely using these keywords only produced a small number of relevant research articles, and the keywords *distraction, noise, workspace, optimized work, sensitivity, and employee* were therefore added to expand the search.

Table 1: Search engines used in the literature search:

Database	Focus	Cover Period
PsychINFO	Psychology and related disciplines	1984 to March 2023
PubMed	Clinical medicine, biomedical sciences, dentistry, preclinical sciences, and general health care provision	1966 to March 2023
SCOPUS	Scientific, technical, medical and social sciences literature	1900 to March 2023

2.3. Office concept:

Open plan office is not described by a standard definition but is in general considered different from cubicle office rooms and can be characterized by having short or no partitions between employees (Samani & Alavi, 2020). Thus, this review utilized Danielsson and Bodin's (2008) office definitions in defining office types in order to maintain consistency between the studies (Table 2). Open-plan office was therefore architecturally characterized by a shared room with no or limited partitions and a minimum of 4 people working in freely arranged workstation groups (Danielsson & Bodin, 2008). In this research however, the size of the open-plan office was not of specific interest and Baranski et al.'s (2023) definition of cubicles was added to the table to account for an office layout that Danielsson and Bodin did not describe.

Table 2: Office Definitions Used in Review

Office Type	Characteristics
Cell-Office	Single room office, no sharing of workspace and amenities with other employees
Shared Room Office	2-3 people in single room, each workstation are often freely arranged in the room, some degree of privacy at the workstation is often provided, employees tend to have similar work assignments
Small Open Plan Office	4 to 9 people share a room, no/limited partitions, workstations often freely arranged in groups, mainly individual work
Medium Open Plan office	10 to 24 people share a room, no/limited partitions, workstations often freely arranged in groups, mainly individual work
Large Open Plan Office	>24 people share a room, no/limited partitions, workstations often freely arranged in groups, mainly individual work
Flex Office/ABW	No individual workstation, often open plan but not a requirement, employee can choose workstation freely, no ability to personalize workstation
Cubicles	Shared office with other employees, partitions that one cannot see over when seated, offers some degree of privacy

Definitions adapted from Danielsson and Bodin (2008) and Baranski et al. (2023).

2.4. Inclusion/exclusion:

The search was refined according to inclusion criteria to restrict retrieved articles only to those responding to the aims of the review. Inclusion criteria required the studies to be peer-reviewed reports of empirical investigations written in English, and they had to be published between 2012 and 2023. Articles that dealt with related fields but did not meet the research objective were excluded. Some studies investigated the relationship between open-plan offices and extraversion by conducting their research directly in open-plan offices, and these

studies could only be included if the office they conducted research in open-plan offices that agreed with the office definitions listed in Table 2.

Articles describing research on activity-based working (sometimes also called *flex office*) also were excluded because this type of office is said to be an upgraded version of the open-plan office where some of the problematic aspects of the open-plan office are dealt with, such as fixed seating (Danielsson et al., 2014; Gerlitz & Hülsbeck, 2023). Thus, the concern was that ABW and open-plan office could not represent each other in answering the research question.

Haapakangas et al. (2016) pointed out a need to investigate the role of specific features within the category of open-plan offices and throughout the research process it became apparent that noise seemed to be a contributor to distraction in the open-plan office. The effect of noise on extraversion was therefore interesting to investigate explicitly (Hedge, 1982., Roelofsen, 2008). Thus, two papers investigating the isolated of noise and extraversion were included in the final dataset. These two articles were included based on the same set of criteria as those mentioned, however they did not need to be related to open-plan office and a requirement was set that they had to use an experimental design.

2.5. Data extraction:

First, the title and abstract of articles matching the mentioned keywords were analyzed to see if they said anything about the relationship between open-plan office and extraversion, dealt with different office conditions in relation to extraversion, or noise and extraversion. Most of the articles dealt with related fields but failed to meet the research object and were therefore discarded. The identified articles that empirically investigated the mentioned relationships were evaluated as complete reports and details on the study population, personality assessment, and the conditions participants stayed in during testing were extracted from these.

Secondly, articles were either included or excluded based on whether they concluded with anything about the relationship between extraversion and office conditions, preferably within the open-plan office. For research conducted within an open-plan office the office used in the research needed to be compatible with the definitions listed in Table 2 for the study to be included. Additionally, because the literature on the theme is so scarce including only articles either using the same or basing their personality assessment on the same inventory

would make it problematic to gather enough articles for the review (Seddigh et al., 2016), Therefore, no article was excluded based on their use of personality assessment.

Articles investigating the relationship between noise and extraversion had to be experimental and the sound-variable used in the study had to be one that is frequently found in an open-plan office. The use of new digital technologies has reduced the noise levels in industries, but the use of new devices such as ventilation systems, computers, printers and other office machinery has problems with low pitched noises which has proved to be a source of annoyance in the office environment (Babmiri et al. 2021). Therefore, only experiments using low-frequency noise were assessed.

A total of 22 articles were found and assessed as a result of the systematic search. However, 11 papers were excluded as they somehow did not meet the requirements of the inclusion criteria. See flow diagram illustrated in Table 3 in Appendix. This left a total of 11 empirical studies that met all the inclusion requirements and the findings of the reviewed articles have been grouped into themes according to the outcomes measured in the different studies.

3. Results:

The 11 articles comprised four main topics: (i) Psychological and physiological well-being in the open-plan office (workplace satisfaction, happiness, workplace image and risk of disability retirement), (ii) Interpersonal job context, (iii) Performance (efficacy, enclosed/exposed environments, productivity and focus), and (iv) Noise management (distraction, noise coping, ability to carry out work and cognitive functioning).

3.1. Psychological and physiological well-being in the open-plan office:

In a Swedish study by Seddigh et al. (2016), the author focused on the interaction effect between office type and personality and the effect of this on employee self-rated distraction, job satisfaction, and performance measured by professional efficacy. The authors could only find small, non-significant interaction effect between extraversion and open-plan office in relation to job satisfaction.

A recent American study carried out by Baranski et al. (2023) found that open-bench seating (equal to what Table 2 describes as an open-plan office) is more beneficial for the

happiness of extraverted employees compared with introverts. The authors found a significant interaction effect between extraversion and workstation type ($p = 0.045$) providing evidence that the extravert nature of employees affects their momentary happiness across different workstation types. This was illustrated in the relationship between extraversion and momentary happiness, which was significantly more positive for employees working in open-plan office than those working in private offices ($p = 0.043$).

According to Huang et al. (2015) extraversion proves to have a positive association with job satisfaction ($p < .001$) and this tendency is moderated by interpersonal job context such that positive effects of extraversion on job satisfaction are accentuated in jobs offering opportunities for interpersonal interaction, thus jobs rich in spontaneous social interactions strengthen the relationship between job satisfaction and extraversion.

Bos et al. (2017) found that less introverted employees moving from a shared room office to an open-plan office reported a strong gain in workplace image, meaning that these employees were more negative about their previous office and more positive about the open-plan office. In comparison, more introverted employees reported a relatively unchanged workplace image.

A Norwegian study by Nielsen et al. (2021) aimed to examine the difference in risk of subsequent disability retirement between employees working in cellular, shared, and open-plan offices determined by the contribution of personality traits. The findings from this research indicated significant differences in prevalence of subsequent disability retirement between respondents in different office designs concerning scores only on openness and neuroticism but not extraversion, and by this did not suggest any impact of level of extraversion on the association between office design and risk for disability retirement.

Table 4: Summary of review papers.

Author	Sample <i>n</i> =and location	Methods	Personality measure	Participant conditions	Key findings
Seddigh et al. (2016)	N=1205, Sweden	Cross-sectional design combining the effect of office type and personality traits on the self-reported outcomes distraction, job satisfaction and performance	The Swedish version of the 50-item International Personality Item Pool (IPIP)	Organizations, departments and office buildings with various office types Comparing employees working in cell, shared, open-plan, and flex offices	Small interactions were found between extraversion and open-office in relation to distraction ($b=.08$; $p > .05$). No interaction between office type and extraversion in relation to job satisfaction
Baranski et al. (2023)	N=231, USA	Traditional one-time survey assessment and momentary measurements on focus and happiness	44-item Big Five Inventory (BFI)	46.82 % of open bench seating (limited partitions, several employees) 31.79 % cubicle, and 21.39 % private office	Significant interaction between extraversion and workstation type $F(2, 158) = 3.16$; $p = 0.045$. Relationship between extraversion and momentary happiness was significantly more positive for employees in open bench seating compared to those in private offices ($F(1, 158) = 6.14$; $p = 0.043$)
Nielsen et al. (2021)	N=6779, Norway	Survey data on predictor variables combined with official objective registry data on disability retirement and sickness absence were extracted from a large Norwegian occupational cohort of office workers	15-item abbreviated version of the International Personality Item Pool (IPIP; 25)	Respondents that reported working in a cellular, shared, or open plan office were retained for analyses Subjects were aged 18-62 and eligible for disability retirement	Extroversion does not impact the association between office design layout and risk disability retirement
Oseland & Hodsman (2018)	N=517, UK & Netherlands	Online survey developed to explore the relationship between noise distraction and variables such as personality	BFI developed by the University of California, Berkeley	53.9% work at an open-plan desk 12.2% private office 14.8 shared office	Extroversion had an insignificant effect on the tendency to get distracted Noise affects introverts' wellbeing and performance more negatively
Lindberg et al. (2016)	N=61, USA	Collected data using online survey software and the survey measured aspects of physical	The Big Five Inventory- 10 (BFI-10), shorter version of the full-length BFI-	Wide variety of office settings and context	Individuals scoring high on extraversion rated their performance in enclosed and exposed work-space environments similarly (M

environment,
perceived control,
coping strategies and
negative symptoms

= 5.30 and M=5.10
respectively), while
individuals scoring low on
extroversion rated their
performance in enclosed
environments higher than
their performance in
exposed environments
(M=5.38 and M = 4.35
respectively)

Huang et al. (2015)	N (in S1) = 5849 & N (in S2) = 23376, USA	Data was obtained from two sources. First, they acquired archival personality and job satisfaction data from an organization that provides online personality assessment and career development services. Second, using the job descriptions respondents provided, they mapped respondents' jobs onto job titles from O*NET to obtain job context rating.	S1 - Personal Style Inventory S2 - The Birkman personality questionnaire	Two archival datasets based on employment pathways	Extraversion of incumbents in a job significantly predicted interpersonal job context. $\beta=.37$, $p=.003$, $\Delta R^2=7\%$ Extraversion and job satisfaction is positively influenced by interpersonal interaction ($\gamma=.13$, $p=.005$)
Appel-Meulenbroek et al. (2020)	N=150, Netherlands	A questionnaire was spread among employees to ask about their personal characteristics and preferences and attitudes regarding coping strategies and various noise sources. They used three companies dealing with noise problems in their open-plan office environment and splitting participants in a medium and in a high extravert group.	Extravertedness was measured with two statements, to which respondents answered on a seven-point scale	All three occupied buildings have an open-plan office concept with noise problems in their office environments	High extraverts are not better in coping with noise than lower extraverts but they use different coping strategies. (χ^2 (df = 11, N = 150) = 23.1, $p = 0.017$).
Roskams et al. (2019)	N=166, UK	Data were collected at three open-plan	Four descriptors were taken from	All three sites were open-plan offices with	Introversion-extraversion was not a significant

office sites in the United Kingdom. Each site was a regional office for a large facilities management organisation, housing knowledge workers completing typical office activities. The study employed a cross-sectional survey design, entailing the completion of a single questionnaire at one time only

The Big Five Mini-Markers Extraversion sub-scale

poor speech privacy due to low or no partitions

predictor for productivity in open-plan offices $p=.031$

Bos et al. (2017) N=70, USA

Research was conducted at a research and development laboratory that does work primarily for the department of defense. The population had moved from shared offices to a newly renovated open plan office. A survey was administered to three conditions: the study group pre-move, the study group post-move, and a comparison set of technical staff working in closed offices from other groups

Ten item introversion scale developed as part of the International Personality Item Pool

All participants moved from shared offices to a newly renovated open plan office

Less introverted employees reported a strong gain in workplace image when moving from shared office to an OPO (before = 3.76, after = 5.45) while more introverted were relatively unchanged (before = 4.02, after = 4.37). They found direct effects of workplace effectiveness and introversion pre and post move as more introverted before = 5.00 and after = 4.15, while less introverted before = 5.18 and after = 5.45

Babmiri et al. (2021) N= 120, Iran

This experimental study exposed each of the subjects to the common sound intensity in industry (50 and 70 decibels) for 40 minutes. Each of the subjects were examined in three situations, before, during and after exposure using the

The Iseng personality questionnaire

Experimental pre-, during- and post-design where participants were exposed to a simulated real environment.

Extroverts performed best post-test and introverts performed best pre-test. Extroverts were not bothered with increased headache problems, difficulty concentrating, confusion, drowsiness or fatigue post exposure but introverts had significantly other problems pre and post exposure.

continuous visual-
auditory function test
and cognitive
functions of
individuals

Alimoham madi et al. (2013)	N=90, Iran	In this experimental study, Stroop and Cognitron computerized tests measured mental performance of participants each exposed to 50 and 70 dBA of LFN and silence, and noise annoyance were measured by a 12- scale self-reported questionnaire	Standardized Iranian version of the Eysenck Personality Inventory	Experimental pretest- posttest design where participants were student volunteers	Introverts conducted the tests faster than the extroverts but during exposure to 70dBA extroverts conducted both tests faster $p < .005$. Introverts were significantly more annoyed by noise than extroverts ($p < .001$)
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3.2. Interpersonal job context:

Huang et al. (2015) hypothesized that the average extraversion of individuals occupying particular jobs would be uniquely associated with the job's interpersonal job context level because they thought extraverts would be more attracted to and stay in jobs providing frequent contact with others. The authors found that the average extraversion of incumbents of a certain job significantly predicted the job's interpersonal job context, thus supporting their hypothesis.

3.3. Performance:

Seddigh et al. (2016) focused on performance measured by professional efficacy and found that extraversion was indeed associated with higher professional efficacy. However, these findings were non-significant and the authors couldn't connect this to a difference between office types.

Lindberg et al. (2016) investigated how extraversion moderated the relationship between work-space enclosure and perceived performance and although the findings were

non-significant, they found that workers scoring high on extraversion did not display any differences in perceived performance between enclosed and exposed workspaces, while individuals scoring low on extraversion rated their performance in enclosed environments higher than their performance in exposed environments.

In the same study, researchers looked at those who said they could do their job well in a workstation where they could not be seen or heard by co-workers and found that those who thought they performed their job well in workstations where they and co-workers could not see or hear each other had a significantly higher introverted score than those who chose workstations where co-workers both could see and hear each other.

Bos et al. (2017) tested for interaction effects of introversion on workplace effectiveness before and after moving to an open-plan office and found direct effects implying that more introverted employees felt that the open-plan office more negatively impacted their effectiveness compared with the shared room office they moved from.

When Roskams et al. (2019) tested their hypothesis saying that more positive ratings on acoustic comfort, well-being, and productivity in the open-plan office would be predicted by higher extraversion they found that higher levels of extraversion indeed were associated with higher levels of productivity in open-plan offices, however, these findings were non-significant ($p=0.31$).

Baranski et al. (2023) demonstrated results showing that the relationship between extraversion and momentary focus differs significantly across individuals working in open-plan offices (referred to as open bench in the article) and in cubicles ($p = .045$) such that as opposed to employees working in cubicles, those working in open-plan offices demonstrated a positive relationship between level of extraversion and momentary focus.

3.4. Noise management:

Oseland and Hodsman (2018) found that the more introverted respondents were, the more negatively they would be affected by noise compared with the extraverted participants, as well as the estimated impact of sound on the performance of introverts was more negative than that of extraverts. Also, stress, well-being, concentration and productivity were rated more poorly when introverts were exposed to noise than extraverts.

Appel-Meulenbroek et al. (2020) performed a study where they failed to detect a significant difference in the perception of different noise sources between high and medium extraverts. However they found that high extraverts were more inclined to cope with office noise by trying to be *more quiet in the hopes that colleagues do the same* while medium extraverts tended to more often chose to *interrupt their work seek distraction and then resume the work or do nothing*. These strategies were however not used a lot and were not expected to have much impact on perceived productivity.

In an experimental study by Alimohammadi et al. (2013) the authors showed that introverts conducted both cognitive tests and sensorimotor speed tests significantly faster than the extraverts ($p < .035$ and $p < .020$) when exposed to office related noise. The introverted participants reported being highly annoyed ($p < .000$) while only 42.6% ($p < .001$) of the extraverts reported being highly annoyed by the noise after being exposed to LFN. By this, the study found a significant relationship between noise annoyance and extraversion and found that the speed of conducting the tests was significantly higher among introverts while accuracy in general was higher, though not significant, for extraverts in all three LFN conditions. Sum of hits in LFN 50 dBA, Stroop test working time of LFN 70 dBA, Cognitrone test working time of LFN 70 dBA and working time under quiet in extraverts were significantly higher than those in introverts.

Babamiri et al (2021) found a significant relationship between cognitive function and extraversion when participants were exposed to environmental stimuli. The results showed that introverts performed better in the pre-exposure situation while extraverts performed better during the exposure, and they also found a significant difference ($p < 0.05$) between the cognitive functions of extroverts and introverts when they increased noise levels from 45 to 60 decibels where the cognitive functions of extraverts improved. They found that the optimal state of arousal for introverts was before exposure while extroverts performed better during exposure to different levels of noise, and none of the problems (headache, difficulty concentrating, confusion, drowsiness, and fatigue) that was observed in extraverts were significantly different before and after exposure.

4. Discussion

The present study aimed to review empirical studies examining the interaction between extraversion and open-plan offices in order to investigate how employees are affected by this kind of office environment based on their extravert disposition. However, as demonstrated via a systematic literature search, few studies exist focusing on this exact topic. The findings of the review have demonstrated four main topics have been investigated in the psychological literature: (i) Psychological and physiological well-being, (ii) Interpersonal job context, (iii) Performance and, (iv) Noise management.

4.1. Reviewing the results:

In line with previous research (e.g Harari et al., 2018; Yang & Hwang, 2014), this review discovered a positive relationship between extraversion and job satisfaction in open-plan offices.

By using the largest sample among the studies included in this review, Huang et al. (2015) found that job-satisfaction was positively correlated with extraversion in jobs rich in social interactions, which appears to be what open-plan offices aim to utilize (Duval et al., 2002).

The fact that open-plan offices aim to enhance communication, collaboration and team cohesion is one possible explanation why Baranski et al. (2023) and Seddigh et al. (2016) found a positive relationship between extraversion and happiness in open-plan offices, suggesting that open-plan offices are less beneficial for the happiness of introverted workers while being more beneficial for extroverts. These findings might be explained by the positive relationship found between extraversion and self-monitoring where more extroverted individuals tend to be better at performing collaborative behaviors than introverted individuals (Kaufmann & Kaufmann, 2020). It is possible that the desire to project a positive image of oneself stimulates extraverted employees to act in manners that beneficially affect the way co-workers attribute the person, hence making the environment respond more positively to the extravert person which in turn has a positive effect on their happiness, while the opposite may be the case for introverts.

Although previous studies have found evidence that the physical health of employees was worsened when moving to open-plan offices (e.g Bergström et al., 2015), this review

only managed to find one study investigating the combined effect of personality and sickness absence in open-plan offices. This study focused on the development of subsequent disability retirement among Norwegian employees and could not find that increased risk for the development of subsequent disability retirement was related to the extraversion score of employees working in open-plan offices (Nielsen et al., 2021). Since the sample only consisted of Norwegian participants, the findings of this study may be problematic to generalize to other countries due to such things as other countries having different well-fare systems and where work conditions differ from the Norwegian standard.

Extraverts appeared to be more attracted to jobs offering frequent social contact with others, implying that working in open-plan layouts may be more attractive for extraverts than introverts (Huang, 2015). Despite this, it was discovered that more introverted individuals seemed to be almost equally positive about the outside impression and attractiveness (workplace image) projected by their previous shared office compared with a new open-plan office, having a small preference for the latter. This is opposed to less introverted individuals who reported a strong increase in workplace image when moving from a shared office to an open-plan office (Bos et al., 2017). A previous study by Augustin and Weidemann (2016) found that people higher in extraversion prefer working in communal workspaces promoting communication, which might explain this gain in the workplace image of less introverted individuals. It is also worth mentioning that extraverted individuals in general are more positive and open to change than less extroverted individuals (Turban et al., 2017). In addition to this, the open-plan office was newly renovated which may have influenced the participants to have a stronger liking for the open-plan office. This might explain why there was observed a small increase in workplace image ratings for people higher in introversion.

All the studies in this review somehow found a connection between extraversion and office layout on performance. It is plausible that the insignificant findings of Lindberg et al. (2016) are due to the use of a small sample. Also, interaction effects are hard to detect in field studies and it is possible that the findings of Seddigh et al. (2016) are the result false negatives where interaction effects that may do exist have been failed to be observed (McClelland & Judd, 1993). Despite this, the studies included in this review have shown that introversion predicts reduced effectiveness while high levels of extraversion are associated with being more productive in open-plan offices (Bos et al., 2017; Lindberg et al., 2016; Roskams et al., 2019; Seddigh et al., 2016). These findings might be explained by personality-based job fit

where extraverted employees benefit more from working in open-plan offices because they offer more social contact and communication among employees, which are attributes favored by extroverts, while attributes favored by introverts (e.g solitude and privacy) are neglected in these offices, leading to a less comfortable work environment that negatively affects their performance (Ashton et al., 2002; Doessy, 2016).

It was hypothesized that the performance of introverts would be negatively affected when working in an open-plan office, whereas the performance of extraverts was thought to be enhanced in this kind of office environment. Current research has partly confirmed these assumptions by discovering a positive relationship between the level of extraversion and momentary focus in different workstation types (Baranski et al., 2023): As opposed to those working in cubicles, employees working in open-plan offices have demonstrated a positive relationship between levels of extraversion and momentary focus. According to this research, the momentary focus of introverted individuals benefits more from working in cubicles and less when working in an open-plan office, whereas extraverts benefit more from working in an open-plan office. This may also partly explain why a study by Augustin and Weidemann (2016) found that introverted individuals reported having a greater preference for workstation dividers providing visual and sound privacy than extraverts.

With increased noise disturbance being one of the primary concerns of employees when transitioning from individual to open-plan offices, this review was set to investigate the effect of extraversion on noise management and found somehow conflicting results. Appel-Meulenbroek (2020) could not find that extraversion level was associated with the perception of different sources of noise typically found in open-plan offices. This study however, measured extraversion by using participant's subjective feedback on two statements only, which was the least thorough assessment tool used by the studies included in this review. By using a more valid personality assessment on a bigger sample, Oseland and Hodsman (2018) on the other hand, found that introversion positively predicted how negatively employees were affected by office noise. Other studies using experimental design also managed to establish a relationship between extraversion and annoyance and cognitive functioning. People low in extraversion tended to be significantly more annoyed by low-frequency noise than people high in extraversion, and extraverts performed better than introverts during exposure to low-frequency noise (Alimohammadi et al., 2013; Babmiri et al., 2021). These findings may perhaps be explained by Eysenck's Theory of Extraversion proposing that

introverts generally have higher basal levels of activity and thus are more highly aroused than extraverts given comparable conditions of stimulation (Bullock & Gilliland, 1993). What this means is that extraverts have a higher optimal level of arousal than introverts, who in general experience greater arousal as a response to lower-intensity noise than extroverts. This implies that the noise conditions caused introverted participants to exceed their optimal level of arousal while it appeared to positively stimulate extraverts and hit their optimal level of arousal at much higher noise-levels at 60 decibels (Cassidy & Macdonald, 2007). Thereby, unlike previously mentioned findings, this review has made discoveries supporting the notion that the effect of noise distraction on performance is modified by extraversion. These studies give an indicator that extraverts in general seem to be less negatively affected in the presence of noise distraction than introverts.

4.2. Conclusion:

The present review systematically collated published peer-reviewed empirical studies concerning the open-plan office concept and extraversion to draw attention to the topic of how office structure affects employees. Answering the proposed research question asking how open-plan office affects extraverted employees compared with introverts, this review found indicators that open-plan office seems to have a more positive impact on extraverted employees than introverts. Based on the included studies, extraversion seems to positively predict the satisfaction and productivity of employees working in open-plan offices. This might partly be explained by the fact that studies have shown that introverts are more bothered by the office-related noise induced in this kind of office than extraverts. The included studies have also established a positive relationship between jobs offering frequent social contact and extraversion, and compared with introverts, the performance of extraverts benefits from working in open-plan offices. This seems to illustrate that open-plan office better fit the preferences of extraverts than introverts, and these offices appear to create a far more disruptive workplace environment for introverts than for extraverts who seem to be positively stimulated by this environment.

4.3. Limitations/Considerations:

This review combined studies using different outcome measurements in the same domains, making it impossible to analyze definitive trends in factors that may have affected the performance, happiness, and well-being of introverts and extraverts in the open-plan office. All studies used different methodologies and varying samples that mainly represented the

Western world and had small sample sizes (7 studies had <200 participants), which may have impacted the generalizability of the findings. The use of personality assessment tools also differed between the studies and most of the studies used small sub-sets of items from existing scales, which raises concerns regarding content validity. Further limitations of this review include the restriction of the inclusion criteria to articles published in English, which may have increased selection bias.

Also, the definition of what constitutes an open-plan office is debated, and there is no clear definition of the physical characteristics, dimensions and number of occupants per space, which makes it difficult to compare study outcomes (James et al., 2021). The studies included in this review were required to meet the office definitions criteria listed in Table 2, but despite this, the different facilities were found to differ from each other in multiple ways concerning the use of partitions, desk arrangement and physical attributes such as lighting and sound isolation. Thus, confounding variables such as workplace culture and physical aspects of the different buildings might have contributed to some of the observed associations, and marks yet another weakness of this research. These limitations should be taken into consideration when interpreting the findings and underline the fact that larger, more robust study designs are needed in order to draw definite conclusions about the theme.

As previous studies have shown that office environment highly influences the productivity of occupants (e.g Frontczak et al., 2012; van der Voordt, 2004), future studies focusing on how employees' well-being and ability to work are affected by their personalities in different office layouts, should also consider the effect of indoor environment quality to better understand these relationships and strengthen the ability to predict different outcomes. Investigating these effects may help explain in further detail some of the findings by Bos et al. (2017), which illustrates the need for this kind of assessment when investigating this theme. Additionally, Rodgers and Barber (2019) showing that personality is a determinant of how employees respond to intrusions when exposed to different workloads, highlights the need for future research to also consider the type of work and workload as a variable that affects the relationship between personality and workspace.

This study divided the extraversion facet into personality types by making an introvert and an extravert category, thereby neglecting parts of the extraversion spectrum that also contain ambiversion. Introvert, ambivert, and extravert is a spectrum of personality traits

within the extraversion dimension where introversion and extraversion only mark the extremes and most personalities are measured somewhere between these two (Petric, 2022). Ambiverts are systematically different from extraverts and introverts and future research should therefore account for this spectrum rather than dividing samples into two categories to capture nuances within the extraversion dimension to increase the accuracy and representativeness of the findings.

Lastly, this review is based on no more than eleven scientific articles and future research should aim to investigate the topic using a far bigger dataset in order to increase accuracy.

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Appendix B: Tables

Table 4: Flow Diagram

