

# Physical Work Environments for Creativity

*A literature review investigating the relationship between organisational creativity and the physical work environment.*

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## Preface

This master's thesis marks the end of a 3.5 year long period as a part time student at the University of Tromsø. Within this time I have also worked as an architect on office and retail projects in Trondheim, Steinkjer and Tønsberg, got married, and have become a parent for the first time.

I began this economy and leadership program with an interest in the correlation between economy and architecture, particularly budgeting and building construction timelines. This master's study, however, is wide-ranging, and I quickly became fascinated by the human and social aspects of an organisation. While designing office buildings throughout Norway, I wondered how the physical framework of an organisation can affect the way people work; potentially influencing everything from interactions with colleagues to an organisation's productivity and results. I drafted floor plans for company offices situated above a shopping centre, sketching in workstations that were placed many metres away from windows, and questioned how this would impact the individuals who would spend their time here and the organisation as a whole. The result is a thesis project exploring the relationship between workplace creativity and the physical office environment.

I would first and foremost like to thank my supervisor Hanne Gabrielsen for her invaluable feedback and support, as well as the University of Tromsø for making this degree possible. I would also like to thank my husband Arnkjell for his encouragement; and finally my son Alfred, who after months of keeping me awake between midnight and 4am at last began sleeping through the night, allowing for this thesis to finally be finished.

## Abstract

This thesis investigates the relationship between organisational creativity and the physical workplace environment, looking at the conditions that are considered to promote or inhibit creativity. The concepts of creativity and the physical work environment are multifaceted and subjective, and the method of a literature review was chosen to navigate this complexity and explore a wide range of sources. A comprehensive search and selection process based upon a feature map identified 18 peer-reviewed journal articles of high relevance. Research designs and assumptions varied significantly across the collected studies, often being based either on empiricism and instrumental perspectives, or upon symbolic relationships of indirect influence. Despite this variation it was unanimously documented that the physical work environment can influence creativity. Elements of the physical workplace that were shown to affect creativity include those that govern basic working conditions, such as light, temperature, sound, and space; a variation of spaces, ideally balancing team and private spaces, work and relaxation or fun; and an overall level of aesthetics and interior design. The reliability of available literature on this topic is limited by the subjectivity and complexity of both creativity and the physical workplace setting, and highlights the need to establish a reliable dialogue between these two concepts in order to holistically study the relationship between them.

# Contents

<b>1. Introduction.....</b>	<b>5</b>
1.1. Thesis Structure .....	8
<b>2. Concepts.....</b>	<b>9</b>
2.1. Outline .....	9
2.2. Creativity .....	9
2.3. The Physical Work Environment.....	13
2.4. Summary .....	15
<b>3. Theoretical Background.....</b>	<b>16</b>
3.1. Outline .....	16
3.2. The Instrumental Perspective.....	16
3.3. The Symbolic Perspective .....	17
3.4. Summary and Expectations.....	19
<b>4. Method.....</b>	<b>21</b>
4.1. Outline .....	21
4.2. Choice of Method: Literature Review .....	21
4.3. Literature Review Design.....	21
4.4. Search Strategy .....	22
4.5. Initial Literature Selection .....	24
<b>5. Presentation of Literature Sources.....</b>	<b>26</b>
5.1. Outline .....	26
5.2. Literature Overview .....	26
5.3. Key Features of Literature Sources.....	29
5.4. Theoretical Perspectives within the Literature.....	31
5.5. Relevance to research question.....	32
5.6. Summary of Two Key Articles .....	32
5.7. Summary .....	37
<b>6. Analysis .....</b>	<b>38</b>
6.1. Outline .....	38
6.2. Documentation that the Physical Environment Influences Creativity .....	38
6.3. Conditions of the Physical Environment for Creativity.....	44
<b>7. Conclusions .....</b>	<b>51</b>
<b>8. References.....</b>	<b>53</b>
<b>9. Appendix.....</b>	<b>58</b>

# 1. Introduction

The purpose of this thesis is to investigate the relationship between workplace creativity and the physical office environment, a concept that has been formed both through my background within architecture and from the study of organisational theory within this degree.

There are many studies that link different qualities of the physical workplace to employee health and satisfaction or company productivity and results, investigating elements such as natural versus artificial lighting or open plan office designs (Ashkanasy, 2014; Clements-Croome, 2005). As an architect I began to wonder what the role of the physical workplace has specifically for creativity and innovation. I find this subject compelling; both from the perspective of an employee working within a creative environment, with an expectation for innovative results, but also as a designer of office buildings and workplaces for others. Can the physical office environment influence creativity at work? What elements of the workplace setting can promote or inhibit creativity?

These questions are not easily answered. While many popular business publications suggest that adding interior elements such as inspiring art or designer work stations will facilitate creativity (e.g. Kobie, 2016), what real evidence lies behind these claims? Are they based on empirical studies conducted within actual organisations, or are they drawing conclusions based solely on assumptions of how creativity can be influenced? There appears to be relatively few academic studies that have attempted to substantiate these assumptions and claims (Kallio et al., 2015), and this thesis aims to identify and examine the evidence-based research exploring creativity and its physical workplace context. As a foundation for investigating the relationship between these two concepts, they will first individually be defined and discussed.

Organisational creativity is a relatively recent line of academic study, dating first to the late 1980's (Shalley and Zhou, 2008). It can be defined as the production of new and useful ideas that are applicable to a problem or opportunity, and that are different from what has been done before (Woodman et al., 1993). Creativity is intrinsically linked to innovation (Amabile, 1996) and often perceived as a necessary element in the development of competitive (Dul and Ceylan, 2011). Within this thesis the term creativity is therefore used to describe a desirable quality in an organisation. Creativity, however, is not easily measurable as it is open to individual interpretation and often not directly connected to outcomes or results (Dul and

Ceylan, 2011). Organisational creativity occurs within the complex social system of an organisation, and is influenced by individual, group or organisational level factors (Styhre and Sundgren, 2005). These factors include the organisational culture and climate (Dobni, 2008), that affect creativity not only through social constructs such as policies and practises, but through the work environment and organisational culture and climate. Due to this subjectivity and complexity, this thesis will further investigate how creativity is defined, measured and operationalised within literature.

The work environment can be defined as the surrounding conditions in which an employee operates, and is composed of both social-organisational and physical factors (Dul and Ceylan, 2011). The physical workplace setting provide contexts for behaviour (Hatch, 1987), and can be a powerful resource for an organisation to support their strategy and improve performance (Levin, 2005). It creates a framework for how people work, and can promote or inhibit particular aspects of employee behaviour and influence an organisation's results (Becker and Steele, 1995). The work environment has traditionally been explored from the instrumental and symbolic perspectives (Rafaeli and Vilnai-Yavetz, 2004). Instrumental studies have investigated how the physical setting supports or hinders specific activities, and how conditions such as lighting and noise control relate to worker efficiency and productivity (Veitch and Gifford, 1996). From the symbolic perspective the physical work environment is seen as an organisational symbol, forming organisational culture, identities and meanings (Kallio et al., 2015). It reflects underlying values and assumptions within the organisation and dictates how people communicate and work, and conveys a rich set of messages about an organisation (Rafaeli and Vilnai-Yavetz, 2004). The concept of the physical environment is again multifaceted and subjective, and requires further investigation.

This complexity makes the study of the relationship between organisational creativity and the physical work environment challenging. Perhaps this accounts for the relatively limited amount of research that exists? These few studies are also scattered across the globe and spread over the disciplines of organisational studies, psychology, design and architecture. In an attempt to navigate this complexity, a literature review has been selected as the method for this master's thesis. The aim is to bring together this published material in an accessible format and update a reader with current research and identify possible gaps in knowledge or areas for future study (Hart, 1998).



With the aim of focusing this literature review, the following two central research questions have been developed:

- 1. Is it documented that the physical workplace environment influences creativity?***
- 2. What physical conditions are considered to promote or inhibit organisational creativity?***

The first question seeks to answer if a relationship of influence between the physical work environment and creativity is shown to exist within the research literature, while the second focuses on which specific factors, conditions or characteristics of the physical environment have been shown to either support or hinder organisational creativity. While validating the presence of such a relationship is necessary for academic purposes, it is these tangible factors that can be adjusted and controlled that intrigue me the most as an architect. Perhaps this study will improve my own work as a designer of office spaces for others?

Comparing studies conducted across different times, places and disciplines requires some critical analysis and stripping back of the underlying assumptions within each study. The two perspectives of instrumentalism and symbolism that have been used within organisational work environment studies can also be applied to the analysis of physical work settings in conjunction with creativity. At a rudimentary level, the instrumental perspective considers organisations as tools to achieve specific goals (Christensen et al., 2015), and allows for the examination of physical work environments and creativity from a highly rational point of view that is based on evidence and empirical research. In contrast, the symbolic perspective causes us to question what aspects of the relationship between workplace creativity and the physical office environment are due to the socially created standards and conventions of an organisation's external environment, and the possible changing fashions within it (Røvik 1998). In addition to uncovering assumptions and lifting information out of its contextual framework, this theoretical grounding gives this thesis direction, allows for the formation of expectations, and assists in the development of analytical frameworks (Thagaard, 1998). Utilising these organisational perspectives will provide a richer and more complete understanding of the relationship between workplace creativity and the physical office environment.

## 1.1. Thesis Structure

The thesis is structured as follows:

Chapter 2 individually discusses the concepts of workplace creativity and the physical office environment to form a solid academic basis for researching the concepts together.

Chapter 3 presents the theoretical framework that forms the basis for this thesis, discussing in detail the instrumental and symbolic perspectives of organisational theory, and the assumptions and expectations for results that they generate.

In Chapter 4 the methodology for the thesis is discussed, detailing the research design of the literature review.

In Chapter 5 the data material is presented. The purpose, method and organisations studied for all data is summarised, in conjunction with a discussion of underlying assumptions and theories and in depth reviews of two articles.

Chapter 6 contains an analysis of the empirical findings, based around the two parts of the central research question.

Chapter 7 concludes the thesis and presents a summary of the findings in relation to the central research questions and theoretical perspectives. Theoretical and methodological weaknesses within the thesis are discussed and areas for future study are considered.

## 2. Concepts

### 2.1. Outline

This chapter aims to present the concepts of creativity and the physical office environment individually in order to form a solid academic basis for researching the relationship between the two topics.

### 2.2. Creativity

Creativity is difficult to define and quantify in academic studies (Dahlen, 2008) and is challenging to measure in organisational results (Dul and Ceylan, 2011). Just within organisational studies, the term creativity has several unique definitions:

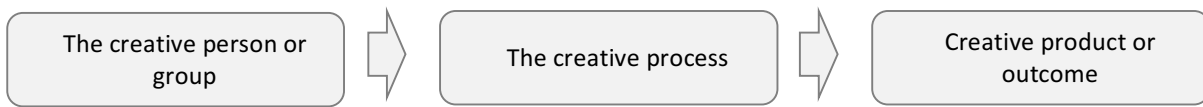
*Creativity is the ability to produce new ideas which are novel to the idea producers themselves. (Drabkin, 1996, p. 78)*

*Creativity is a process resulting in a product; it is the production of a novel and appropriate response, product, or solution to an open-ended task. The response must be new, but it must also be appropriate to the task to be completed or the problem to be solved. In addition, the task must be open-ended, rather than having a single, obvious solution. (Amabile & Mueller, 2008, p. 35)*

*Creativity is a novel product that attains some level of social recognition. (Sawyer, 2006, p. 27)*

*Creativity is ... an attribute of individuals... The social and cultural conditions, interacting with individual potentialities, brought about by the objects and behaviours we call creative. (Csikszentmihályi, 1994, p. 144)*

These dissimilar descriptions reveal how subjective creativity is, and it is often this subjectivity that makes creativity so challenging to quantify (Martens, 2011). These definitions also illustrate creativity's complex and dynamic nature. Either the creative person, the creative process, or a creative outcome is prioritised in a singular definition. Scientific literature written about creativity often uses these three divisions to analyse how creativity works (e.g. Amabile, 1996, Hoff and Öberg, 2015); the creative person or group is involved in a creative process, that can then be developed into a creative idea, product or outcome. This sequence is graphically displayed in *Figure 2.1*.



*Figure 2.1 Creativity as a Process*

This multifaceted definition is central to this thesis' exploration of creativity. It allows us to understand that it is within this central step, the creative process, that external environmental conditions have the greatest potential to influence creativity. The variety and subjectivity of the definition of creativity means that it will need to be identified and questioned within each potential source of this literature review.

The concept of creativity is also closely related to innovation. While some literature uses the terms synonymously (Sawyer, 2006), others differentiate between the concepts by defining innovation as a creative idea that has been successfully implemented, and thereby viewing creativity as the starting point for innovation (Amabile, 1996; Woodman et al., 1993). The relationship between creativity and innovation is also reflective; the implementation of innovations also has the potential to affect the motivation and generation of new ideas. Successful innovation may also come from ideas that come outside an organisation, such as technology transfer. Despite these additional sources of innovation, internal creativity in an organisation is a key factor in the generation of new and useful ideas, and creativity is therefore perceived as a desirable quality in an organisation that is closely linked to innovation and lasting competitive advantage (Dul and Ceylan, 2014).

### **Theories of Organisational Creativity**

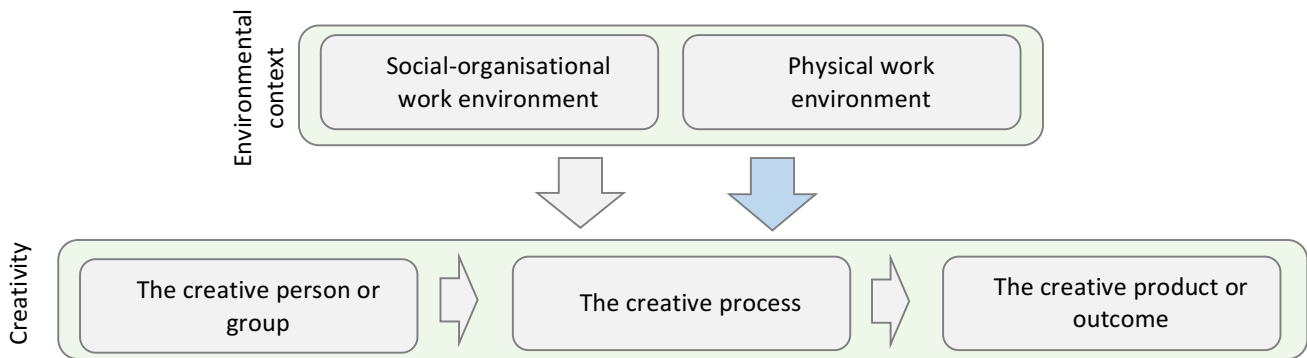
There are several established theories explaining how creativity works in an organisation. Woodman et al. (1993) claim that creativity is the product of a person's behaviour in any given context, and propose the "Interaction Model for Creativity", where a company's creative results are based on individual's interactions and relationships within the organization. These relationships can be complex since each person's creativity is also based on personality, behaviour, knowledge, motivation, social and contextual influences. While this model is based on social-organisational characteristics, the physical setting is mentioned as a necessary contextual element to support creativity.

Amabile and Mueller (2008) discuss the "Component Theory of Creativity" that defines three major organizational components that generate a company's innovation. The first factor is

the organisation's motivation for creativity, which includes how creativity is encouraged and supported in the workplace. The second is what resources are available for innovation work, such as time and space, and thus include the physical workplace. The third is comprised of management factors, including elements such as freedom or autonomy during work, degree of challenges and interest in work, individual work or teamwork, and communication of goals. While the majority of these factors can again be seen as social-organisational characteristics, the physical work environment is also described as an element that can either promote or block creativity.

Similarly, both Sternberg and Lubart's "Investment Theory of Creativity" (1991) and Csikszentmihályi and Sawyer's "System Theory" (1995) discuss qualities that can affect creativity, and while social-organisational characteristics such as personality, intelligence and motivation are continually emphasised, the physical work environment is again briefly referred to as an additional factor of influence to organisational creativity. Csikszentmihályi and Sawyer (1995) make the additional point that the focus should be shifted from characteristics that relate to the individual to workplace conditions, because it is much easier for management to change these conditions than, for example, trying to influence an employee's personality or intelligence.

While focusing on different and specific aspects of creative behaviour, all of these theories segregate the work context into two dimensions; the social-organisational work environment, comprised of elements such as job design, management, freedom, autonomy, pressure, teamwork and leadership, and the physical work environment that refers to the material workplace surroundings. The social-organisational context has predominantly been viewed as more important, possibly as it fits into existing organisational theory frameworks (Peltonen, 2016), but the existence of this physical context is in itself of interest to this thesis, as it confirms that a relationship does exist between workplace creativity and the physical office environment. These two dimensions can be added to the graphical representation of creativity mentioned earlier in this chapter, as shown in *Figure 2.2* below.



*Figure 2.2 Creativity and Environmental Context, adapted from Amabile and Mueller (2008) and Dul and Ceylan (2011).*

Figure 2.2 graphically displays how the environmental context can influence creativity through impacting the creative process step. It is in this “active” phase of creativity that the environment has the potential to change creative products or outcomes. The arrow highlighted in blue within the figure denotes the relationship between the creative process and the physical work environment, and is the focus of this thesis.

In reality, the interaction between environmental factors, individuals, the organisation and the larger context is much more complex and dynamic than this conceptual model suggests. The same environmental context can have different implications for specific individuals, and can lead to different creative outcomes. The reduction of creativity to a simple linear process that can be directly affected by environmental factors, however, allows for a level of clarity necessary to investigate causality and elements of influence within this relationship, and can begin to generate expectations with regard to the central research question of this thesis. The theories of organisational creativity discussed above suggest that the physical office environment can indeed impact workplace creativity. The existing literature on organisational creativity, however, does not discuss the physical workplace in enough detail to give any expectations of what particular aspects could promote or inhibit creative behaviour. Due to the variation in defining creativity, the way that every potential source within this literature review has done so will need to be individually considered.

### 2.3. The Physical Work Environment

The physical work environment can be defined as the surrounding physical conditions in which an employee operates (Dul and Ceylan, 2011). It is comprised of everything from furniture and interior design to the hierarchy and use of spaces, and creates a basis for how people work, how employees behave and how an organisation performs (Becker and Steele, 1995). The organisation's physical structure works on two levels: Firstly, in an instrumental sense, it defines how and where tasks are performed and people interact. Secondly, at a symbolic level, it embodies the company's hierarchy, culture and identity (Rafaeli and Vilnai-Yavetz, 2004).

The majority of studies undertaken on the physical work environment have been performed at an instrumental level (Veitch and Gifford, 1996), and predominantly focused on how the physical space promotes or inhibits specific activities.

Ambient conditions such as lighting, temperature and noise control have often been studied in conjunction to employee welfare or organisational productivity (Clements-Croome, 2005). These studies are of interest to this thesis as it is reasonable to assume that workspaces optimising wellbeing or productivity will have a great deal in common with a workplace designed for optimal creativity (Amabile, 1996). Many of the same basic requirements must be fulfilled for both productive and creative work, and the factors or physical elements that promote or hinder productivity could potentially also impact creative behaviour and outcomes.

Many studies have ascertained that a good physical environment can increase productivity substantially. Doggart (2000), Leyten (2003), Lomonaco (1997), Lorsch (1994), Roelofsen (2001) and Wyon (1996) all report productivity increases between 5-20% from improving the physical work conditions. Elements that have been documented to be of influence include furniture, indoor plants/flowers, calming or inspiring colours, privacy, window views, lighting, indoor climate, sounds, smells and building layout. While many of these elements are repeated across these studies, they are all open to personal interpretation and preferences, and ideal solutions will vary widely between individual employees and different workplaces. Despite these irregularities, these elements have the potential to also influence workplace creativity in similar ways to how they affect workplace productivity, and can be used as a starting point to form expectations and guide research.

Further instrumental studies examine how the physical workspace can influence decision making, group collaboration and worker interactions. Physical space and distance are documented to be crucial to communication (Allen, 1977; Hatch, 1987; Oldham and Brass, 1979), where an increased distance of only several metres often decreases spontaneous interactions and all forms of communication. Physical barriers, however, have been documented to have mixed effects, with some studies suggesting increased individual communication occurs in walled or heavily partitioned office settings (Hatch, 1987, 1990), possibly due to increased privacy or less external distractions (Oldham and Brass, 1979). Group or interdepartmental interactions, however, are documented to be negatively influenced by physical barriers, although mutually shared facilities such as break rooms can assist communication (Elsbach and Bechky, 2007).

One common element of analysis within the physical work environment is open plan office designs. Studies here also offer mixed results, because while interactions can be increased by open layouts, this often comes at a cost of lower workplace satisfaction (Kim and de Dear, 2013; Sundstrom et al., 1982), increased distraction and loss of privacy (Kaarlela-Tuomaala et al., 2009). The suitability of open plan designs is documented to be dependent on aspects such as the complexity of the employees' tasks (Maher and von Hippel, 2005; Oldham and Brass, 1979) and on the equal availability of spaces for interaction or individual concentration (Sailer, 2011).

Alternatively, research conducted on the physical work setting at a symbolic level considers the physical attributes of an organisation to be symbols capable of forming organisational culture and identity (Hatch, 1993; Lindahl, 2004), and reflecting intrinsic values and assumptions within the workplace (Schein, 1990). Elsbach and Bechky (2007, p.87) write that "just as anthropologists point to objects as the visible part of culture, office design and décor can be thought of as the visible part of the culture of an organization". This process can occur on several levels; size and location of an individual's office can create feelings of importance and status (Hatch, 1990; Sundstrom et al., 1982) or personal customisation can allow for feelings of individuality and self-worth (Elsbach and Bechky, 2007). The physical framework of the office conveys many messages about an organisation, and influences how people communicate and work (Rafaeli and Vilnai-Yavetz, 2004).



This existing basis of literature on physical work environments allows for the creation of expectations for this thesis' main research question, including elements of the physical workplace that could affect creativity. Workplace creativity could be affected by interactions, communications, privacy and an individual's perceptions and feelings at work, and therefore either supported or hindered by the physical work setting. The symbolism of a physical workplace environment reflects underlying values and assumptions within the organisation and dictates how people communicate and work, including potential creative work and outcomes. The duality present in aspects such as open plan office design or physical barriers can be assumed to be present when investigating physical work settings and creativity, as a process as complex and dynamic as creativity requires space for both team collaboration and communication as well as individual focus or privacy.

## 2.4. Summary

This chapter has discussed how creativity can be defined and formed into an academic concept, including how theories of organisational creativity have distinguished between social and physical environmental influences. The study of the physical work environment has documented that it can dramatically influence an organisation, and specific elements could act to hinder or promote creative outcomes in similar ways to that they affect productivity. This material allows for the generation of expectations of this thesis' central research question, including an assumption that the physical workplace environment could influence creativity.

## 3. Theoretical Background

### 3.1. Outline

This chapter discusses the organisational theoretic perspectives of instrumentalism and symbolism, which have been chosen to help cultivate a conceptual and academic understanding of the relationship between creativity and the physical work environment. Grounding this thesis in two viewpoints offers several key advantages: (1) it delivers a theoretical foundation with the potential to give the study direction, (2) it forms the basis for the research questions, and (3) it assists in the development of analytical frameworks (Thagaard, 1998). Both concepts will be explored, and the chapter concludes with a summary of the expectations that this material generates for the central research questions in the thesis.

### 3.2. The Instrumental Perspective

The instrumental perspective is derived from several schools of organisational theory that have developed during the last century, including ideas of specialisation and standardisation within scientific management; the rationality, hierarchy and divisions of labour within classical bureaucracy theory; and classical administration theory (Christensen et al., 2015). The central idea is that organisations are tools for the effective generation of goods and services (Røvik, 1998). Organisations have no intrinsic value in themselves, and are reduced to instruments to achieve specific goals that have been deemed important by society (Christensen et al., 2015). These goals are usually rationally predetermined by management, but can also be influenced by environmental factors.

From the instrumental perspective different organisations can be perceived as relatively similar systems; working in comparable ways, facing the same problems, and thus requiring the same solutions (Røvik, 2007). This creates the expectation that the relationship between creativity and the physical work environment will work in a similar way within most organisations, and that elements of the physical workplace will universally promote or inhibit creativity.

Another principle within the instrumental perspective is that successful practise generates organisational concepts (Christensen et al. 2015). It is only through the effective creation of

goods and services that organisational concepts gain popularity and momentum. Creativity, and its importance for an organisation's success and lasting competitive advantage, is one such concept that gained popularity in the 1980's and is still gathering momentum today (Shalley and Zhou, 2008). The value of the physical workplace can also be perceived as another such concept, dating at least as far back as the Industrial Revolution and the efficiency studies conducted on workplaces then (Dul og Ceylan, 2011). We can therefore assume that when the physical environment or specific elements of it are generally perceived as factors that influence workplace creativity, it is because they have been proven to do so in practise.

From an instrumental perspective, the incorporation of concepts within organisations will primarily occur as a rational way to achieve goals or solve problems. Implementation of these ideas will usually succeed if management has a central role, with top down leadership (Røvik, 2007) and adequate political and social control (Christensen et al., 2015). Due to the rationality in this process and that new concepts have generally already been proven to be successful in practise, the effects of attempted change will normally be as expected (Christensen et al., 2015). Concepts usually require little adaptation and are highly transferrable from one organisation to another due to the relative similarity between organisations (Røvik, 2007). It can therefore be assumed from instrumental theory that changes within the physical work environment or changes aimed to increase creativity will primarily occur as a rational way to achieve goals or solve problems. An organisation can potentially make the rational decision to support creative work through the office setting. Furthermore, best practices involving creativity and the physical work environment will be identifiable within organisations, removable and transferable between organizations, and provide approximately the same effects within most organisations.

### 3.3. The Symbolic Perspective

According to the symbolic perspective organisations occur in surroundings comprised of socially created standards and conventions that then dictate the operation and design of the organisation (Røvik 1998). The resultant form of an organisation is based on its interpretation of these norms and conventions. These standards of organisational design can be viewed as external, objective, efficient and highly rational, and can thereby be institutionalised (Røvik 1998). The organisation's environment can be seen to govern how

particular types of organisations are established, organised, operated and managed, and it is a common and accepted practise that organisations adopt and incorporate prevailing systems and procedures from this external environment (Meyer and Rowan, 1977). These externally dictated conventions and standards are also constantly changing, and even institutional surroundings are therefore highly unstable (Røvik 1998).

Within this perspective, concepts or practises can be viewed as meaningful symbols (Røvik 1998), where their value lies far beyond the practical solutions they may offer. Following current institutionalised fashions is necessary for competitive advantage, and failure to comply with environmental expectations can set an entire organisation's legitimacy in question (Brunsson 2006). The legitimising potential of popular concepts or practises does not, however, mean that they are effective tools or offer evidence-based results. It is also this lack of documentation supporting their performance that characterises socially created concepts or practises as symbols.

An example of the symbolic perspective at play within the field of physical work environments can be seen within the use of open plan offices. Traditional office design in the twentieth century used physical barriers such as walls, partitions and doors to define managerial status and support individual decision making (Becker and Steele, 1995). The beginning of the twenty first century, however, witnessed a large-scale shift within the private sector to open up workspaces, placing all levels of employees in one continuous space. While there are definitive factors that influenced this change, such as an increasing emphasis on teamwork and the reduction of middle management (Peltonen, 2016), organisations as a collective can be seen to have embraced this fashion as it was an accepted element of organisational design, overlooking the fact that it may not suit all types of businesses. The concept of open plan layouts were seen as a symbol of efficiency and modernisation, despite certain drawbacks such as noise pollution, reduction in job satisfaction, concentration and performance, and even in some cases, reduced face to face interactions (Bernstein and Turban, 2018; Kaarlela-Tuomaala et al., 2009; Kim and de Dear, 2013; Sundstrom et al., 1982). As seen through open plan office design, that fact that concepts relating to the physical work environment are widely adopted does therefore little to validate their actual effectivity. This thesis will need to distinguish between the adoption of concepts due to fashions and social standards, or their implementation due to evidence-based documentation.

Symbolism can also be seen on a larger scale within the concept of organisation creativity. In early organisational models creativity was viewed as a quality only necessary for a select few individuals within leadership, with labour often divided into small and specialised tasks and standardised processes (Dul and Ceylan, 2011). This line of thinking dominated until the late twentieth century, when the concept of organisational creativity began to gain momentum. Recent literature now describes creativity as a vital resource for employees across all organisational levels (Madjar et al., 2002; Shalley et al., 2004), and a quality necessary for lasting competitive advantage (Dul & Ceylan, 2011).

Concurrently the study of the physical work environment within organisational literature has increased recently (Peltonen, 2016), and following the success of the interior designs of the Google, Apple, IDEO and 3M offices, has perhaps received unprecedented attention (Dul & Ceylan, 2014). This increase in interest surrounding both the physical office environment and workplace creativity suggests that they are both fashions within the current organisational environment; and with successful implementation they become symbols of legitimacy and success for an organisation. As relatively new concepts they have perhaps not been entirely institutionalised; their use is not universally viewed as external, objective, efficient and highly rational, but the process has arguably begun.

These evolving environmental conventions have inherently impacted the selection of this thesis topic, that was also undertaken with the presumption that it would generate interesting and relevant results. All literature reviewed must therefore be viewed in light of its symbolic assumptions and my possible intrinsic bias. The symbolic perspective causes us to question what aspects of the physical workplace, studies or results are due to changing fashions and the socially created standards and conventions of an organisation's environment.

### 3.4. Summary and Expectations

This chapter has discussed how two key perspectives within organisational theory can shed contrasting light on the relationship between creativity and the physical work environment. This material allows for the generation of expectations to this thesis' central research questions, as summarised in *Table 3.4*.

Table 3.4 - Expectations Based Upon the Instrumental and Symbolic Perspectives.

	<b>The Instrumental Perspective</b>	<b>The Symbolic Perspective</b>
<p><b>Research question 1:</b>  <i>Is it documented that the physical workplace environment influences creativity?</i></p>	<p>We can expect to find a relationship between the physical office environment and creativity if it has been proven to do so in practise.</p> <p>An organisation can make the rational decision to support creative work through the office setting in an effort to meet goals, and in this instance the relationship between the physical office environment and creativity is governed by instrumentalism.</p>	<p>We can expect to find a relationship between the physical office environment and creativity if it is normally accepted to do so.</p> <p>Increase in interest surrounding both the physical office environment and workplace creativity suggests that they are both fashions within the current organisational environment; and with successful implementation they become symbols of legitimacy and success for an organisation.</p>
<p><b>Research question 2:</b>  <i>What physical conditions are considered to promote or inhibit organisational creativity?</i></p>	<p>While no specific elements have been brought forth, this perspective creates the assumption that the relationship between creativity and the physical work environment will work in a similar way within most organisations, and that elements of the physical workplace will universally promote or inhibit creativity.</p>	<p>While no specific elements have been brought forth, this perspective creates the assumption that elements of the workplace are important as symbols to represent that the organisation is creative, over their purpose to specifically generate creative behaviour or outcomes.</p>

## 4. Method

### 4.1. Outline

This chapter will begin by discussing this thesis' choice of method, a literature review, followed by a detailed search strategy and feature map. The chapter will conclude with a discussion of reducing the initial literature selection to a comprehensive yet concise list of primary sources.

### 4.2. Choice of Method: Literature Review

A literature review involves creating a summary or synthesis of already published material, and by doing so provides a means of updating readers with current research and identification of gaps in knowledge or areas for future research (Hart, 1998). This method has been selected as a means to gather and analyse research material in order to best address this thesis' main research question. It presents the opportunity to assemble knowledge from from a wide variety of disciplines and physical locations, and explore the literature's variation and scope.

### 4.3. Literature Review Design

Frey (2018) identifies four key criteria for a literature review; (1) it must be comprehensive, including all main sources; (2) it must be relevant, excluding material that is not pertinent to the topic; (3) it must be up to date, representing contemporary research and thinking; and finally (4) it must be unbiased with the viewpoints that it propagates. In order to meet these conditions several stages have been followed, as presented in *Figure 4.3*. Corresponding thesis chapters are written to the right of each point.

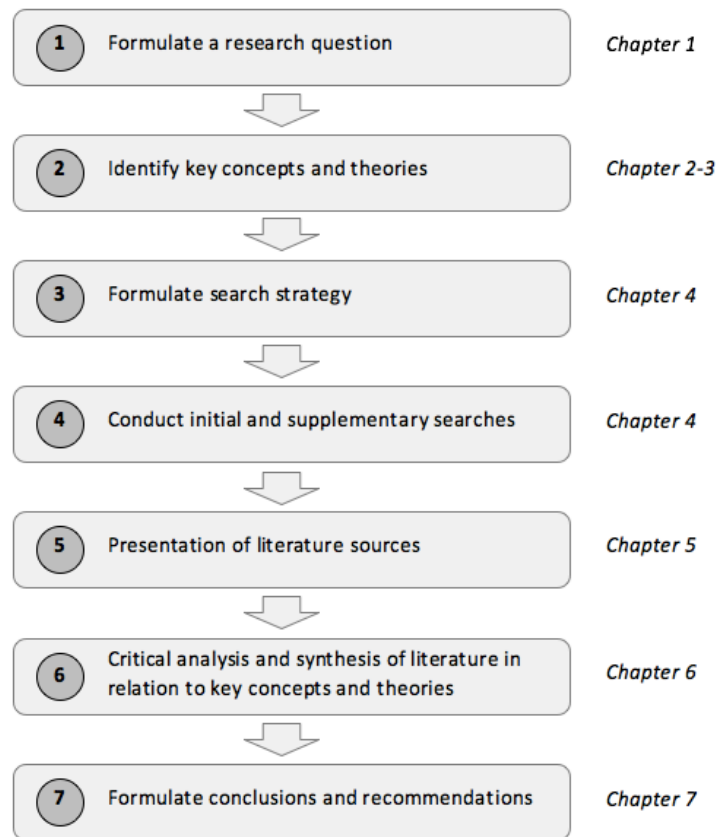


Figure 4.3 Stages of a Literature Review with Corresponding Chapters in Thesis, adapted from Frey (2018).

#### 4.4. Search Strategy

The purpose of this search is to compile an extensive list of sources that can be used to conduct a reliable, unbiased and contemporary literature review. The following steps are summarised within *Appendix Table 1* and the number of sources identified in each step is listed.

##### **Step 1 - Initial Database Search (374 000 sources)**

BIBSYS, an administrative agency established and run by the Ministry of Education and Research in Norway, provides a unified search service, Oria, for the entire material available at Norwegian educational and public libraries. The breadth and ability to control search parameters makes this both a comprehensive and functional place to begin the search process.

Key search terms have been identified within Chapters 1-3 and are listed in *Appendix Table 2*. These terms relate to two key areas; creativity and the physical work environment, and to



maintain relevance search results included at least one term or phrase from each group. Additional terms, more specific in regards to creativity, and broader in scope of the physical work environment, aim to identify articles that are both outside of the initial search criteria whilst maintaining relevance.

### **Step 2 - Refinement for Reliable and Contemporary Sources** (226 sources)

To ensure reliability of source material the initial database searches will be refined to only include peer reviewed articles. While this may initially exclude potentially relevant research, such as conference papers and doctoral theses, this protocol will ensure consistency within the material presented. Reliability will be assessed in more detail as part of the feature map.. In order to focus on current and relevant research this literature review will initially limit itself to written sources published within the last twenty years, thereby creating a more contemporary representation of physical work environments for creativity. This strategy is adapted from Frey (2018). Sources identified in later stages of this search process may be outside this time frame.

### **Step 3 - Initial Relevance of Sources** (34 sources)

Material that is not pertinent to the topic will be excluded, until only relevant sources remain. This process will firstly occur through a quick assessment of the article title and thereafter abstract. This process is dependent on initial perception of relevance and while all other parts of this search process are replicable, this step, while necessary, is open to subjectivity and potential inherent reader bias or error. Relevance will be assessed in more detail after the initial selection of articles as part of the feature map process.

### **Step 4 - Empirical Studies** (19 sources)

Empirical studies involve the collection and analysis of primary data, allow for knowledge transfer through direct and indirect observation or experience, and thus offer many advantages over conceptual studies (Gagnon, 1982). Many companies have established dedicated spaces to encourage creativity (e.g. Royal Mail, Dutch Tax Office), however these spaces and their success often appear to be based on instinct and personal judgement rather than evidence based research (Moultrie et al., 2007). There is little empirical validation if the design as a whole, or particular features of it, actually promote creativity. In order to accurately address the primary research question of this thesis the search strategy will prioritise empirical studies. While it is possible that foundation or other important material

will be excluded, empirical sources contribute a wider variety of perspectives and primary data, central for the reliability and relevance of the results for this thesis.

#### **Step 5 - Citations** (903 sources)

The identification of initial material allows for the discovery of further relevant sources through looking at the articles cited within these articles and using citation tracking to see which newer articles cite the earlier identified articles. These processes are often called snowballing and reverse snowballing and can be repeated until no further relevant articles are found.

#### **Step 6 - Initial Selection** (43 sources)

Steps 2-5 are repeated for the additional sources identified through citations. This process involves several rounds as further sources are uncovered in step 5.

#### **Step 7 - Feature Map** (18 sources)

A feature map or questionnaire has been utilised within this thesis to conduct a systematic and replicable evaluation of sources. *Appendix table 3* details the feature map used to assess possible literature for reliability and relevance to the primary research question, and further evaluate the selected primary sources for analysis and discussion as conducted in Chapters 5 to 7. This process was based on Hart's discussions of classification and reading material for a literature review (1998), and involves assessing sources based on specific characteristics. Through looking at these detailed qualities of identified sources only articles with a sufficient purpose, theoretical basis, research design and pertinence to this thesis' research questions will be selected for further analysis.

### **4.5. Initial Literature Selection**

*Appendix Table 4* displays the initial selection of 43 articles compiled through the search process and the results of several key questions from the feature map, primarily pertaining to reliability and empiricism of sources. The method through which the source was first identified is listed, with over half of all articles being identified through either snowballing or reverse snowballing techniques. This indicates that the database search and initial judgement of relevance (steps 1 and 3) were insufficient in themselves, and it is only through including steps 5 and 6 that the search process becomes comprehensive. The final column in this table includes a short assessment of each source.

Through examining SJR Journal H-indexes, Google scholar author H-indexes, citations used within each article and the number of times each article in itself has been cited, most articles have been deemed reliable. While each of these measurements are not necessarily highly dependable (Hart, 1998), when combined they do offer more robustness. Two articles (Sheykhani and Saghaee, 2011 and Wycoff and Snead, 1999) that had low numbers across all of these measurements were deemed inadequate for this thesis.

Eight articles were eliminated due to low relevance either to the physical work environment or to creativity, as assessed within part 3 of the feature map. Eight further articles were judged to be too specific, typically focusing on only one particular aspect of the physical work environment such as lighting or indoor plants. While these articles contain important supplementary information, they were not deemed relevant enough to be considered as primary literature.

Finally, several articles were excluded due to the data used within their research, as considered within parts 4 and 5 of the feature map. Two articles displayed little empirical data, one article (Puccio et al., 2000) was excluded because the data that it used as part of its empirical study was of low reliability, and one last article (De Paoli & Ropo, 2017) was excluded as it was based on data collected and assessed in another study selected and was therefore considered too repetitive. This comprehensive selection process based upon the feature map resulted in eighteen literature sources, which will be presented in the following chapter of the thesis.

## 5. Presentation of Literature Sources

### 5.1. Outline

This chapter will discuss the collected data material from the literature search, and will begin with an overview of all articles, summarising their purpose, methodological approaches and the organisations upon which their research is based. The chapter will continue with a discussion of this material as a whole, their relevance to the research question, and the theoretical perspectives that are both consciously and inadvertently used within the literature. Following this, two articles will be presented in detail, providing contrasting perspectives of organisational theory.

### 5.2. Literature Overview

The selected literature consists of 18 international peer-reviewed journal articles. The validity, reliability and relevance of these sources has been deemed sufficient as discussed within Chapter 4. *Table 5.2* provides an overview of the articles and summarises their purpose, research design and the organisations discussed within the study.

*Table 5.2 - Literature Overview*

<b>Author/s, (Year) and Source</b>	<b>Title</b>	<b>Purpose</b>	<b>Research design</b>	<b>Organisations in study</b>
Bisadi et al. (2012) Procedia - Social and Behavioral Sciences	Future Research Centres: The Place of Creativity and Innovation	To identify effective spatial characteristics of a university research center that assists creativity.	2 questionnaires, firstly (n=12) defining how a research centre could increase creativity; secondly (n=90) evaluating effects/results.	Architecture and urban design research centre at universities across Tehran, Iran.
Ceylan et al. (2008) Human Factors and Ergonomics in Manufacturing	Can the Office Environment Stimulate a Manager's Creativity?	To explore if a manager's physical office work environment can stimulate their creativity.	Questionnaire: 60 managers rated the creative potential of offices shown in 25 photographs.	A large private manufacturing facility (automobiles and machine parts) in Bursa, Turkey.
De Paoli et al. (2017) Journal of Management & Organization	The Spatial Context of Organizations: A Critique of 'creative workspaces'	To explore workspaces designed to foster creativity and critique stereotypes.	Qualitative study, descriptive photo analysis of 40 images of creative workspaces for 5 variables.	Advertising, design, banking, software, consulting, law, IT, engineering, games, entertainment firms.

Dul & Ceylan (2011) Ergonomics	Work Environments for Employee creativity	Test hypothesis that a creative work environment enhances creative performance. To create an instrument to analyse work environments for creativity.	Questionnaire: 409 employees scored 21 identified factors that could influence creativity from 1-7. A further case study on one company to assess how their values compare to benchmarks.	Employees from 49 organisations in the Netherlands, varying size and industry. Case study organisation: large pest control company, 22 administrative office workers partook in study.
Dul & Ceylan (2014) Journal of Product Innovation Management	The Impact of a Creativity-Supporting Work Environment on a Firm's Product Innovation Performance	To investigate the effect of a creativity supporting work environment on product innovation performance at a firm level.	The creativity supporting work environments of firms was assessed in questionnaires, while creative performance was evaluated by new product productivity and sales income.	103 industrial sector firms in Turkey, various industrial sectors, about half small (less than 250 employees) and half large. Informants from within HR & leadership.
Dul et al. (2011) Human Resource Management	Knowledge Workers' Creativity and the Role of the Physical Work Environment	Exploring if the more a knowledge worker perceives support from the physical or social work environment, the higher their creative output is.	Questionnaire survey method (n=274) of knowledge workers investigating individual self-perceived creativity and 21 variables.	27 small and medium sized organisations in the Netherlands, varied industries but all with a typical office environment.
Haner (2005) Creativity and Innovation Management	Spaces for Creativity and Innovation in Two Established Organizations.	To evaluate two case studies of spaces designed specifically to promote creativity and innovation.	Comparative descriptive case study of two facilities.	Large private firms; the Fraunhofer Office Innovation Center in Germany, and an undisclosed Scandinavian financial institution.
Hoff & Öberg (2015) International Journal of Human Resource Management	The Role of the Physical Work Environment for Creative Employees – a Case Study of Digital Artists	To explore the role of the physical environment for creative employees.	Semi structured interviews with 13 digital, 4 face-to-face, remaining via email. Results of these interviews are generalized and descriptive.	6 organizations in video game or movie production within Sweden, England, Germany, Norway and the USA. 100 to 2000 employees.
Kallio et al.(2015) Facilities	Physical Space, Culture and Organisational Creativity – a Longitudinal Study	To investigate the effects of design of the physical environment on the emergence of an organisational culture conducive to organisational creativity.	Qualitative longitudinal case study with interviews and personal observations over two periods, before and after a relocation.	A regional newspaper company with 115 employees in Finland.

Lee (2016) Facilities	Creative workplace characteristics and innovative start-up companies	To explore the factors of the physical work environment that can promote creativity in start-up organisations.	In depth structured interviews to assess physical work settings for 7 characteristics and a questionnaire covering significance and implementation issues.	22 start-up (less than 10 years old) private companies in Michigan, in industries such as sciences, defence, manufacturing and energy production.
Lewis & Moultrie (2005) Creativity and Innovation Management	The Organizational Innovation Laboratory	To analyse 'innovation laboratories', spaces dedicated to encourage creativity.	Visual examination of the architectural and interior features and technology infrastructure of 3 facilities. 14 semi-structured interviews to assess observed creativity.	3 UK innovation spaces, at the Royal Mail office, the Department of Trade and Industry, and the staff development hub at the University of East Anglia.
Lukerman & Burgess-Limerick (2013) Ergonomics	The Perceived Importance and the Presence of Creative Potential in the Health Professional's Work Environment	To examine the relationship b/w creativity and work environment factors for health care workers, and the presence of these environmental factors in their workplaces.	Questionnaire: the importance and presence of 25 work environment factors to support creativity was rated from 1 to 7, as well as self-perceived creative performance.	361 participants from within the public health care sector (mainly occupational therapists) in Australia.
Martens (2011) Facilities	Creative workplace: instrumental and symbolic support for creativity	To gain insight into the relationship between the physical workplace and creativity.	Ten in depth semi structured interviews with leaders within creative industries.	Majority London based architects working in small private firms.
McCoy & Evans (2002) Creativity Research Journal	The Potential Role of the Physical Environment in Fostering Creativity	To investigate the role that specific interior design elements have on creativity.	Firstly (n=60) photographs of workspaces were analysed for characteristics that promote creativity. Secondly (n=20) creative performance was tested in 2 different settings.	Undergraduate students in USA (study 1), and high school students (study 2).

Sailer (2011) Facilities	Creativity as Social and Spatial Process	To study creativity in the workplace and its interrelation with physical space.	Semi-structured in depth interviews with 22 leaders, questionnaires with 360 employees, observations of space usage and floor plan analysis before and after a relocation.	A large UK private media corporation in the publishing industry.
Stokols et al. (2002) Creativity Research Journal	Qualities of Work Environments That Promote Perceived Support for Creativity	To investigate the relationship between perceived support for creativity at work and employee wellbeing.	Cross sectional empirical study, questionnaire to 97 office workers and recordings of environmental conditions at each workspaces.	The University of California (public institution) across 4 campuses and many disciplines.
Van der Lugt et al. (2007) Creativity and Innovation Management	Future Center 'The Shipyard': Learning from Planning, Developing, Using and Refining	To provide a comprehensive case description of a facility dedicated to creative work.	Qualitative descriptive case study of one facility.	Future Center 'The Shipyard' of the Dutch Tax and Customs Administration.
Vithayathawornwong et al. (2003) Journal of Interior Design	The Role of the Physical Environment in Supporting Organizational Creativity	To explore how the physical environment supports creativity by identifying features perceived to promote or inhibit creativity.	Quantitative and qualitative questionnaire (n=130).	4 mid to large sized organisations in the USA, with comparable and acclaimed social environments and contrasting physical settings.

### 5.3. Key Features of Literature Sources

#### Time and Place

The selected literature sources have been published between 2002 and the present day. They represent a wide geographic area, with articles being linked, either through place of empirical study or an author's academic association, to USA, Europe, Australia, Turkey and Iran. While this breadth is considered sufficient for a literature review of this size, it should be noted that western organisational models dominate this research, with only three sources being linked to non-western countries.

While these articles represent a large number of different researchers there is some repetition, with Jan Dul and Canan Ceylan having authored or co-authored a total of 4 articles. This is based on the specific and continuing research focus of these individuals. In the context

of only eighteen total sources, however, it could be problematic. These articles include different empirical studies, are conducted in different countries and periods in time, and are therefore still included, with consideration taken to possible bias.

## **Research Design**

While the purposes of all of these articles is on some level to investigate the relationship between creativity and the physical workplace context, key differences can be seen in their methodologies. There appears to be four main types of research designs:

The first set of articles (Kallio et al., 2015 and Sailer, 2011) are longitudinal studies following one organisation at several points in time and documenting if a change in physical space influences perceived creativity.

The second set of articles (Bisadi et al., 2012; Haner, 2005; Lewis & Moultrie, 2005 and Van der Lugt et al., 2007) examines spaces designed specifically for creative work, such as innovation laboratories.

The most common research design involves analysing organisation's workspaces for their creative potential in cross sectional studies. These studies are conducted with both quantitative (e.g. Dul and Ceylan 2014; Lukerman & Burgess-Limerick, 2013) and qualitative (e.g. Lee, 2016; Martens, 2011) research designs. These studies often include substantial discussions of physical workplace features believed to promote or inhibit creativity.

The final group of articles involves studying photographs of workspaces instead of actual organisations (Ceylan et al., 2008; De Paoli et al., 2017; McCoy & Evans, 2002). This research design presents some advantages, allowing researchers to segregate particular physical elements (Ceylan et al.) or allowing one individual to consider their creative potential across several work environments (McCoy & Evans), but also disadvantages since the studies are conducted on a theoretical platform, instead of upon real experiences and organisations.

These four types of research designs act to provide a wide set of empirical data, and while comparisons between studies of differing methodologies can be challenging, retaining these varying sources allows for a greater degree of breadth, knowledge and experience to be collected within this thesis.



### **Measuring Variables within the Studies**

As discussed in Chapters 1 and 2 it is challenging to measure subjective and individual qualities such as creativity and physical settings, and this is reflected in the literature. Many sources consider only individuals' self-perceived creative performance, and relatively few studies have attempted to look at creativity at an organisational level. Often the author's own descriptions and interpretations of physical settings have been included despite potential irrelevance, and very few studies empirically recorded values such as temperature or noise levels. When measuring variables at an organisational level two key approaches have been used within the literature. The first involves interviewing several employees and looking at their collective individual perceptions, while the second approach is comprised of selecting a knowledgeable key informant, usually working within human resources or management, to provide a firm score. Both methods have strengths and weaknesses, and are open to individual interpretations and bias. These difficulties highlight the challenges faced when subjective and essentially qualitative concepts such as creativity and the influence that physical space has upon behaviour are subjected to empiricism. This presents some challenges for this thesis, that must attempt to analyse each data source individually before comparison, and will ultimately influence the strength of any conclusions.

### **5.4. Theoretical Perspectives within the Literature**

Both instrumental and symbolic perspectives are initially discernible within this selection of literature. Instrumentalism can be seen in studies that have investigated how the physical setting supports or hinders creative activities, studying particular elements such as lighting, temperature and sound. Relationships between the physical office environment and creativity are proven to do so in practise in these studies, and we can see that the relationship between creativity and the physical work environment is thought to work in a similar way within most organisations, and that elements of the physical workplace are assumed to universally either promote or inhibit creativity.

Conversely, symbolism can be seen in studies where a relationship is assumed to exist between the physical office environment and creativity because it is normally accepted to do so. Increase in interest surrounding both the physical office environment and workplace creativity suggests that they are both fashions within the current organisational environment; and with successful implementation they become symbols of legitimacy and

success for an organisation. Elements of the physical workplace are important symbols to represent that the organisation is creative, contributing to an organisational culture and environment as a whole that is conducive of creativity.

## 5.5. Relevance to research question

All eighteen of the selected literature sources are relevant to both research questions, suggesting that the exploration of physical environmental influences in the workplace upon creativity cannot occur without investigating how this process occurs and thereby what factors within the environment promote or inhibit creativity. The two parts of the research question therefore appear to be dependent upon each other, and even studies focusing on only one section, for example discussing specific physical conditions (e.g. Lukerman and Burgess-Limerick, 2013) clearly document that creativity is influenced by the physical workplace conditions.

## 5.6. Summary of Two Key Articles

In order to provide a deeper insight into the literature selection two articles were selected for a thorough review and presentation. These sources display contrasting assumptions, methodologies, and explorations of the research question. The first article, Dul and Ceylan (2014) appears to be based upon instrumental techniques, and has been selected due to its quantitative and highly rational methodologies and both interesting and dependable results. The second article (Kallio et al., 2015) discusses the symbolic value that the physical environment as a whole has for workplace creativity, and has been selected due to its relevance to the research questions and reliability. Together these articles demonstrate the breadth and variation within the selected literature.

### **The Impact of a Creativity-supporting Work Environment on a Firm's Product Innovation Performance (Dul and Ceylan, 2014)**

Jan Dul is a Professor of Technology and Human Factors at the Erasmus University Rotterdam in the Netherlands while Canan Ceylan is an associate professor at Uludag University in Turkey. They have authored or co-authored over 8 publications focusing on creativity and its

relationship to both the social-organisational and physical work environments, and are considered leading experts in this field of study.

The organisations involved in this study are 103 firms in the Bursa region in Turkey from various industrial sectors, including automobile, textile, food and service trades, and ranging from small to medium size firms (56%) with less than 250 employees to large firms with up to 7500 employees (44%).

This article studies the relationship between the creativity supporting capabilities of an organisation's work environment and creative performance through individually assessing variables. Firstly, a system for evaluating the creativity supporting potential of work environments was constructed, measuring 9 socio-organisational and 12 physical environmental variables on a seven-point scale. Key informants from within human resources and management were selected to complete questionnaires, and all variables were assessed at a firm level in order to thereby consider the workplace environment at an organisational level.

The selection and importance of these 12 physical environmental variables primarily takes place in earlier works by these authors (Ceylan et al., 2008; Dul and Ceylan, 2011) and includes furniture, indoor plants and flowers, calming colours, inspiring colours, privacy, window views to nature, any window views, quantity of light, daylight, indoor physical climate, sound (positive sound) and smell (positive smell). It is interesting to note that the mean scores for the realisation of these variables varies across firms from 3.1 (inspiring colours) to 5.0 (indoor physical climate), suggesting that some work environment elements that can influence creativity are more universally optimised than others. Scores for individual elements were summarised creating an overall index value for each firm, ranging from 30 to 145, with a mean score of 90.

Creativity and innovative performance were concurrently evaluated through obtaining data on new product productivity; the extent to which a firm introduces a new product into the market, and new product success; the percentage of the firm's sales from new products. These values were quantified on two five-point scales with an observed range from 2 to 10, and a mean score of 6.5. Further control variables such as organisation age, size and industrial sector were also included. Again, a key informant method was used, this time focusing on management staff within research and development.

The results of this study shows a strong correlation between a work environment supporting creativity and product innovation performance. A regression analysis of the creativity supporting work environment on new product productivity shows a regression coefficient differing significantly from 0 (coefficient .23 and  $p < .05$ ), confirming that the more an organisation's overall work environment supports creativity, the more new products an organisation introduces into the market. Similar results were shown with new product sales (coefficient .31 and  $p < .05$ ).

This empirical and quantitative study can directly answer the first part of this thesis' main research question. This study conclusively documents that the physical workplace environment of an organisation can influence creative performance as measured by new product generation and success. The second part of this thesis' research question is also indirectly answered through the elements of the physical environment that are assessed for their creativity supporting potential.

Through analysing the standardised regression coefficients for creativity supporting work environments for new product success, Dul and Ceylan further calculate how much a firm could realistically increase new product sales by improving their work environments. If an organisation with a work environment score of 90 was to increase this to the maximum observed score of 145, they could expect to increase new product success by 50 - 70%. The authors argue that this can be realised as the creativity supporting work environment consists of separate elements that can be individually manipulated. This presents an instrumental perspective, where an organisation can make the rational decision to support creative work through the office setting in an effort to meet goals, and in this instance the relationship between the physical office environment and creativity is thus governed by instrumentalism.

While this study present strong and convincing results, it does have some limitations. The conclusions are based upon one sample of organisations in Turkey, and replication should be undertaken on other firm populations before the results are generalised. Data collection was also limited to one informant per concept and therefore has lower reliability than if several informants had been used. Other data collection methods than self-reporting, such as observation, measuring of physical variables and document analysis could also be undertaken. Finally, while significant correlation between work environment and creative output has been documented, this does not necessarily indicate direct causality.

## **Physical space, culture and organisational creativity – a longitudinal study (Kallio, Kallio and Blomberg, 2015)**

Tomi Kallio, Kirsi-Mari Kallio and Annika Blomberg are consecutively a professor, associative professor and postdoctoral researcher at the University of Turku in Finland. While this appears to be their first publication specifically focusing on creativity and physical space, both Kallio's are well published authors within organisational studies.

The purpose of this article is to explore the relationship between the design of a physical work environment and organisational creativity. The research design involves a qualitative longitudinal case study involving thematic interviews and personal observations over two periods in late 2007 and mid-2009. During this time the organisation studied, a regional newspaper company with 115 employees, relocated from amalgamated offices across 4 floors and 3 buildings, to a centralised, carefully designed and newly renovated facility.

The first wave of interviews focused on the office layout with separate walled rooms for different departments and administration, long corridors, narrow stairs and small elevators, resulting in a dark, archaic and authoritarian space. It was perceived that despite management promoting an egalitarian, innovative and forward-looking culture, the physical environment of the organisation symbolised a backward-looking, conservative and hierarchical culture that hindered organisational creativity.

The second wave of interviews was undertaken 9 months post relocation. Employees from all departments of the organisation had been involved in the design process of the new offices, choosing an unconventionally designed layout with unique and playful elements. These new premises included greater degrees of openness with less separation through walls and levels, and both intra- and inter-departmental interaction increased. Most ambient conditions were improved in the move, such as the availability of natural lighting, with the only negative exception being higher levels of disturbance and distraction through noise levels in open spaces. Isolated and soundproof spaces were available for concentration work. It was perceived that the new facilities broke the stigma associated with the traditional site, and a newer, innovative and forward-looking culture was established. This organisational climate was conducive to creative work and positively influenced organisational creativity.

This case study demonstrates how the design of the physical work environment can influence organisational culture, and can become a tool to instigate positive cultural change. The

physical office environment can allow for a culture conducive to organisational creativity, specifically through openness, equality and collectiveness. The first part of this thesis' research question is clearly affirmed, as this study documents that through improving the physical office environment workplace creativity was positively impacted.

This study is also highly relevant to the second part of the research question. Kallio et al. discuss eight factors of the physical work environment that can influence organisational creativity and thereby either promote or inhibit creativity. A traditional location can limit organisational culture, thereby hindering creativity, while an edgy location can propel a forward facing identity that promotes creativity. Multiple floors can limit employee interactions and communication and negatively influence creativity, while fewer levels can increase a sense of belonging, collectively, equality and openness that is conducive to creativity. Divisions of space, both at organisational and departmental levels can inhibit creativity through separation provided by walls, floors and partitions, long corridors, narrow stairs and small elevators. Open spaces with minimal divisions and wide corridors and stairs facilitate the free flow of information, including fewer emails and more meetings that occur spontaneously. This contributes to a sense of collectiveness and was thought to stimulate organisational creativity. Formal or hierarchal break spaces, such as those organised by managerial level or departments can hinder a creative organisational environment, while collective, inclusive and informal spaces can promote creativity. The general aesthetics of the original offices, with worn out and dated interiors, conservative art and small windows detracted from the company image. Contrastingly, the unconventional and playful decor, a sense of history and high ceiling height of the new offices create feelings of appreciation, togetherness, openness and equality that contribute to an innovative image and an organisational culture that supports of creativity. Finally, creativity can be hindered by status barriers such as private offices for management, and promoted through the feeling of equality with no visible status symbols, and standardised workstations for all employees.

Within this study, the physical work environment is documented to be an organisational symbol, forming organisational culture, identities and meanings. It reflects underlying values and assumptions within the organisation, conveying a rich set of messages about the organisation and ultimately dictates how people communicate and work, clearly influencing their creative potential.

## 5.7. Summary

This chapter has presented 18 contemporary sources that contain relevant and reliable documentation of the relationship between creativity and physical work environments. This set of materials meets all necessary conditions discussed in Chapter 4 for a dependable literature review (Frey, 2018) and simultaneously displays contrasting assumptions and methodologies. While 18 is high number of sources for a literature review, each article presents new and relevant information and the following chapters will attempt to synthesise and analyse this body of material in relation to this thesis' research question.

## 6. Analysis

### 6.1. Outline

This chapter addresses the two key research questions, as introduced in Chapter 1. Firstly, is it documented that the physical workplace environment influences creativity? Secondly, what conditions or elements of the physical workplace are believed to promote or inhibit organisational creativity? This analysis aims to provide insight into the relationship between creativity and the physical work environment in a clear and concise format.

### 6.2. Documentation that Physical Environment Influences Creativity

The purpose of this section is to analyse the data pertaining to the first research question. In order to compare, contrast and efficiently summarise different literature sources, they will be grouped according to their research design, as discussed in Chapter 5.

#### **Longitudinal Studies**

The first set of two articles (Kallio et al., 2015 and Sailer, 2011) are longitudinal studies following two organisations at several points in time during their relocations to new facilities. Studying creativity in a single organisation before and after a change of workplace environment allows conclusions to be drawn on the influence of physical space, since it is the only significant changing variable between the pre- and post-relocation studies.

Sailer views creativity as a social process, and therefore focuses on interaction patterns as a fundamental contributor to creativity. Spaces for chance encounters with people from different teams were realised in the relocation, and shown to positively impact perceived creativity. Separate spaces for communication and concentration were not realised to an extent that promoted creativity, and the ability to concentrate remained an issue among employees. This article highlights the difficulty in measuring creativity as an output variable, and while a link is established between physical spaces and interaction patterns, the article only conceptually argues that it is this change that has increased perceived creativity.

The study undertaken by Kallio et al. (2015), which is discussed in detail in the previous chapter, details the perceived creativity among employees before and after relocating from



traditional and hierarchical offices to a new, modern centralised office space characterised by unique and playful elements. Kallio et al. also conclude that given the complex nature of physical work environments and organisational creativity it is almost impossible to analyse the direct relationship between the two. The authors use the concept of an organisational culture conducive to creativity as a construct to connect the two key phenomena. They describe how the physical space in a workplace can be used to advance cultural change, and in particular advance the emergence of a culture promoting organisational creativity. In this way the authors establish that the physical work environment does indeed influence organisational creativity.

These studies only measure self-perceived creativity and creative performance, which may not directly correlate to creative outcomes for the organisation. This form of self assessment is also open to several forms of documentation error, bias, inconsistency and subjectivity, which greatly limits the empirical quality of these studies and weakens the instrumental results. These studies primarily act to demonstrate that it is through the symbolic value that the physical workplace environment encapsulates that creativity is influenced.

### **Spaces Specifically for Creativity**

The second set of four articles (Bisadi et al., 2012; Haner, 2005; Lewis & Moultrie, 2005 and Van der Lugt et al., 2007) examines spaces designed specifically for creative work, such as innovation laboratories. Together, these studies examine 7 facilities predominately in Europe, with only one case study based in Iran. Despite these studies involving different organisational types and sectors, all facilities had similar design philosophies and comparable spatial and interior features. Architecture and interior design were utilised to stimulate and inspire creativity, with unconventional layouts, unusual wall shapes and fun and playful elements. Spaces specifically for creative work are generally described to be beneficial to workplace creativity, possibly through reinforcing corporate commitment to innovation. Disadvantages include substantial financial investments and a limited lifespan.

Through using case studies these articles collectively describe a prototype for what designers consider a “creative” space to be, but offer little empirical support demonstrating if and how these spaces actually function to support creativity. Symbolism has been at play here, both in the construction of these spaces and their evaluation in these articles. Such “innovation laboratories” are arguably an organisational trend of the early twenty first century, whose

significance for a company extends far beyond the hopefully innovative work that is undertaken in these spaces. They function as a status symbol of creativity, potentially attracting creative employees and assisting in an organisation's legitimacy as innovative, thereby promoting competitive advantage and the business as a whole.

### **Cross Sectional Studies**

The next subset of literature sources have research designs involving analysis of organisations workspaces for their creative potential in cross sectional studies. These studies are both conducted with quantitative (e.g. Dul and Ceylan 2014; Lukerman & Burgess-Limerick, 2013) and qualitative (e.g. Lee, 2016; Martens, 2011) research designs.

In a study by Dul and Ceylan (2011) 409 Dutch employees from 49 organisations, varying in size and industry completed questionnaires that evaluated their workplaces for perceived support for creativity across 21 factors in the work environment, including 12 physical qualities. These authors also wrote the first article summarised in Chapter 5, and similar frameworks were used in both studies. This study shows a positive and significant correlation between a creative work environment and creativity (correlation coefficient 0.28 and  $p < 0.001$ ), confirming the hypothesis that the higher an employee perceives support for creativity to be, the higher their creative performance is. These calculations assume that each environmental factor is equally important within the numerical data. While most theories of organisational creativity stress the importance of social-organisational environmental factors, they are in the minority in this study (9/21), which could be a flawed assumption to the extent that some of the numerical aspects in this study are of little value. For example, it is unlikely that the presence of calming colours is of equal importance as recognition of, or incentives for, creative ideas.

Despite the possibly of flawed assumptions in this study, interesting empirical validation to this thesis's first research question is still present. Similar results can also be seen in the other studies conducted by this research team; two studies involving 274 employees from 27 medium sized organisations in the Netherlands (Dul et al., 2011), and 60 managers from a manufacturing company in Turkey (Ceylan et al., 2008), also conclude that the physical environment influences workplace creativity. Creativity at an organisational level was investigated across 103 firms in Turkey (Dul and Ceylan, 2014), and demonstrated again the influence of the physical work space on creativity.

In contrast to the first articles discussed in this chapter, these studies contain instrumental methodologies and assumptions. They attempt to prove that a relationship between the physical office environment and creativity exists in practise through utilising rational arguments and numerical data. This instrumental perspective creates the assumption that the relationship between creativity and the physical work environment will work in a similar way within most organisations, and the results generated appear to confirm these assumptions across several industries and organisation models.

In several of these studies creativity has been measured in terms of the amounts of new products generated and the success of these new products. Assessing creativity in this way appears to be more dependable than the earlier discussed studies that have relied on employees self-percieved creativity. It offers an empirical solution to quantify and document creative performance. It may, however, be questioned if it is really creativity that is being measured in these studies. For example, it is conceivable that the amount of new products generated is a result of meeting the constantly changing environmental demands, rather than a direct result of employee creativity. New product success could also be a result of careful market analysis and major advertising efforts, and not a consequence of organisational creativity. Finally, it may be questioned whether the number of new products released is an inherently relevant variable to assess across different organisational models.

As seen in Chapter 2 creativity is a complex phenomena. It is a quality possessed by individuals and teams, and while in an ideal linear model the result is a creative product or service, that then contributes to a companies innovation and competitive advantage, creative work may not necessarily end in clear results. In my personal experience as an architect, it is usually not the most creative ideas that are built or become the most successful buildings. The problems discussed with measuring both self-percieved and product-related creativity cause me to question whether it is inherently possible to reliably quantify such a complex and subjective concept as creativity across different organisations.

Perhaps the solution could be smaller scale considered and detailed studies tailored to individual organisations or employees? Martens (2011) conducted ten in depth semi-structured interviews with leaders within creative industries in the UK. The interviews concluded that the physical work environments of these individuals can both stimulate and inhibit creativity. Martens describes that this often happens in an indirect way and the relationship between creativity and the physical environment has both plurality and

complexity. Similar conclusions were reached by Lee (2016) through questionnaires completed by 26 representatives from 22 start up firms across varying industries in Michigan; and Hoff and Öberg (2015) with semi-structured interviews with 13 digital artists working within office environments in Europe. While these studies attempt to establish that a relationship of influence exists between the physical work environment and creativity, the number of participants is low, and the research design methodologies are not explained in detail to the reader. This makes it unclear if creativity and the physical environment have been assessed reliably or replicably.

### **Photographic Studies**

The final group of articles involves studies based on photographs of workspaces instead of actual organisations. In one such investigation by McCoy and Evans (2002) content analysis of photographs was undertaken by 60 university students in the USA. Images were rated by their size, shape, light, surface materials and internal organisation and according to where participants felt like they would feel most and least creative. Through identifying environmental characteristics that independently predict greater perceived creativity this study documented that the physical workplace environment can influence expected creative behaviour. This hypothesis was tested further through creating two prototype spaces based upon these results; one that optimised elements shown to promote creativity and one based upon elements that inhibit it. The creativity of 20 students was then measured as they performed tasks within each space and creative performance was shown to be greater in the setting that had been highly rated for its creativity potential.

Similar results were obtained through other studies based on workspace images (Ceylan et al., 2008; De Paoli et al., 2017). Using photographs as opposed to actual workplaces can be problematic; aesthetic and inspirational aspects may receive more focus, at the expense of function and practicality (Hoff and Öberg, 2015). Documenting what people stereotypically consider to be a creative space, however, still offers some value, especially given the individual and subjective nature of creativity. Although the relevance and reliability of these studies is comparatively low, they demonstrate similar results to the earlier discussed sources, demonstrating again that physical space does impact creativity.

## **Summary**

In all eighteen literature sources it has been documented to varying extents that the physical workplace environment influences creativity. There are several articles that indicate a direct and instrumental relationship (e.g. Dul and Ceylan, 2014), while other studies conclude that this relationship of influence is symbolic (e.g. Kallio et al., 2015). It is interesting to note that all of these studies are based upon the same symbolic assumptions that this thesis is; that there exists a relationship of influence between creativity and the physical, and that studying this relationship would generate interesting and relevant results. The uniformity and apparent strength of these assumptions causes me to question if it is possible to obtain contradictory conclusions while working from within this environment. Even studies conducted with a basis in instrumentalism and rational empirical data display influences of symbolism, following current organisational customs and trends. It can be questioned what aspects of these studies' results are due to changing fashions and the socially created standards and conventions of an organisation's environment, and what aspects really discern that the physical work environment influences creativity. With all available research at least in part based upon symbolism, we must expect to find a relationship between the physical office environment and creativity because it is normally accepted to do so. Perhaps the final conclusion of this analysis should simply be that an accepted concept in today's organisational climate is that the physical setting of the workplace can influence creativity and act as a symbol of legitimacy and innovation for an organisation.

### 6.3. Conditions of the Physical Environment for Creativity

This section will analyse the data pertaining to the second part of the research question, and seeks to uncover the conditions or elements of the physical workplace that are documented to promote or inhibit creativity. Several key compilations of environmental characteristics will be presented, followed by a discussion of the central conditions that have frequently been documented.

The most referenced and cited list of conditions that can foster creativity is that compiled by Ceylan et al. (2008), which is summarised in *Table 6.3.1* below.

*Table 6.3.1, Element of the Physical Work Environment that Can Foster Creativity, adapted from Ceylan et al. (2008).*

Element of physical work env. that can foster creativity	Description
<i>Furniture</i>	Furniture such as desks and chairs in the workplace.
<i>Indoor plants/flowers</i>	Natural plants or flowers in the workplace.
<i>Calming colours</i>	Colours that aid relaxation, such as green, blue or violet.
<i>Inspiring colours</i>	Colours that can stimulate and inspire, such as yellow, orange, pink or red
<i>Privacy</i>	The possibility of being away from the presence or view of others.
<i>Window view to nature</i>	Visual access to the natural environment such as trees or plants.
<i>Any window view</i>	Visual access to an outer environment.
<i>Quantity of light</i>	The amount of light in the workplace.
<i>Daylight</i>	Natural sunlight in the workplace.
<i>Indoor climate</i>	Temperature, humidity and air quality.
<i>Sound</i>	Positive sounds such as music, silence, or absence of noise.
<i>Smell</i>	Positive odours, such as fresh air or absence of bad smells.

Many of these physical elements have been studied individually in different studies (e.g. odour by Knasko, 1992; plants by Shibata and Suzuki, 2004; and lighting by Kombeiz and Steidle, 2018; and Steidle and Werth, 2013) and have been documented as influencing creative behaviour. Several later studies conducted by Dul and Ceylan (2011, 2011 and 2014) quantitatively reinforced that these physical environmental features promote organisational creativity in varied organisational settings. A study conducted by Lukerman and Burgess-Limerick (2013) of 361 healthcare workers in Australia also investigated these characteristics' comparative and absolute importance for fostering creativity, as summarised in *Table 6.3.2* below.

*Table 6.3.2, Perceived Importance and Degree of Implementation Rated on a Scale of 1-7 for Physical Work Environment Factors, Adapted from Lukersmith and Burgess-Limerick (2013). SD = Standard deviation.*

Physical work environment variable	Importance mean, n = 361	SD	Realised mean, n = 361	SD
Daylight	5.38	1.50	4.18	1.97
Quantity of light	5.31	1.45	4.46	1.78
Indoor (physical) climate	5.16	1.40	3.89	1.71
Sound	4.96	1.45	3.50	1.69
Privacy	4.85	1.46	3.52	1.86
Window view to natural elements	4.79	1.86	3.77	2.16
Any window view	4.78	1.77	4.22	2.16
Smell	4.48	1.63	3.66	1.76
Furniture	3.61	1.64	3.36	1.64
Inspiring colours	3.41	1.67	2.53	1.47
Calming colours	3.29	1.67	3.09	1.66

The traits of lighting, both the quantity and the presence of daylight, the indoor physical climate (including temperature, humidity and air quality), privacy and sound (or lack of noise) were perceived to be the most important physical factors for creativity in this population. Window views, including those to nature, were considered important. Furniture, plants, inspiring colours and calming colours were of significantly less importance, with mean scores under 4 out of 7. It is interesting to note that with the exception of these last four less important physical traits, the mean importance scores for the other physical environment features were in the same order of magnitude to the values for social-organisational environmental factors that were investigated (not shown in the table above), ranging from 4.33 to 5.85. This suggests that traits of the physical environment are equally important in support of creativity as social-organisational factors.

Several of these findings are also reinforced within the other primary literature sources in this thesis. Through conducting in depth interviews with leaders within creative industries in the UK, Martens (2011) concludes that the most important physical factors for workplace creativity are sound, temperature and privacy. Lack of these qualities significantly inhibits creative work. Stokols et al. (2002) interviewed 97 university office workers in California and simultaneously took temperature, sound and space measurements of office conditions. Again, the measured environmental distractions of noise, lack of privacy and foot traffic around workstations substantially decrease perceived support for creativity.

From the discipline of psychology comes studies like the one conducted by Hoff and Öberg (2015) on digital artists in Sweden, England, Germany, Norway and the USA. Here individual creativity is viewed as a process, and after conducting in-depth interviews the authors suggest that the physical environment can offer support for creativity in three ways; functionally, through increasing job performance and decreasing distractions; psychosocially, through increasing well-being and decreasing stress and social barriers at work; and inspirationally, through creative and inspiring surroundings. These documented findings are summarised within the following table, *Table 6.3.3*.

*Table 6.3.3, Elements of the Physical Work Environment that Can Support Creativity, Created from a Discussion by Hoff and Öberg (2015).*

Element of Creative Support	Description
<b>Functional support</b>	<b>Increase job performance and decrease distraction</b>
<i>Ergonomic tools and furniture</i>	Computers, standing workstations, etc.
<i>Lighting</i>	Consistent and controllable, availability of daylight, windows.
<i>Distraction-free space</i>	Sound levels in open plan offices problematic.
<i>Adequate space</i>	Personal space, as well as for changing team configurations.
<i>Adjustable spaces and furniture</i>	Team level support: Support both interactive and autonomous work, flexible spaces for collaboration.
<b>Psychosocial support</b>	<b>Increase well-being and decrease stress and social barriers</b>
<i>Private space</i>	Needed for undisturbed work, less distractions and noise.
<i>Customised space</i>	Need to express personality in personal space, perceived freedom.
<i>Window view</i>	Positive effect on wellbeing; provides break from “head space” needed in creative work. Natural views preferred.
<i>Stress management space</i>	Combat overtime. Leisure and game corner, chill out areas, space to nap, exercise. Wellbeing from a home-like supporting atmosphere. Possibly increases a desire to work longer.
<i>Space for connection and communicating ideas</i>	Team level support: Open plan landscape facilitates communication and spread of ideas, and potentially increases creativity, and gives a feeling of being in a coherent group.
<i>Informal social spaces</i>	Team level support: facilitate bonding, improved teamwork
<i>Non-hierarchical spaces</i>	Team level support: idea that a feeling of equality is conducive to creativity. E.g. open plan spaces.
<b>Inspirational support</b>	<b>Increase creativity and quality</b>
<i>Creative place</i>	Inspiring physical environment can facilitate creative processes, inspire them to happen in the office, create an organisational image that attracts creative employees.
<i>Inspiring architectural planning</i>	Stimulating: flexibility, dynamic, varying levels, sizes and openness. Inhibiting: uniform, fixed, repetitive.
<i>Inspiring interior design</i>	Stimulating: colour, texture, artwork, plants. Inhibiting: sterile environments.
<i>Spaces for brainstorming</i>	Team level support



Here we find many of the same elements that Ceylan et al. (2008) have described, such as privacy, furniture, lighting and window views. Additions to the original list can be seen to fall into two categories. Firstly, spaces with specific purposes are included, such as spaces for connection and communication, distraction free work, stress management and creativity. Secondly, there is a focus on aesthetics that was barely conveyed in the original twelve characteristics. Inspiring and stimulating interior design and architectural planning bring to mind very different workspaces than the simply described colour palates named by Ceylan et al. (2008).

Hoff and Öberg (2015) maintain that all three of these types of support for creativity must be present for optimal creative work environments. The contradiction between a desire for open plan spaces for communication flow and a concurrent requirement for quiet and sheltered private spaces for creative work is discussed, and combated by the author's suggestion of several specific purpose spaces. This concept of several varying workspaces, instead of one universal space, challenges the assumptions of the first group of studies discussed. What constitutes balance between an inspirational space and a distracting one appears to be highly individual, with little consensus relating to some elements of interior design, such as colour and use of artwork. Something that can be found inspiring to one person, can be found distracting to another. The physical environmental support for teams is also documented to potentially collide with that for individual creative work. Perhaps the main message of this study is one of duplicity, flexibility and individualism.

Similarly, Haner (2005) discusses how sequential spatial layout and design accommodate the flow of creative thinking within the study of spaces designed specifically for creativity in Scandinavia and Germany. This study also places weight on the importance of stimulating interior design including unusual shapes and forms, colour, materials, light and furnishings to stimulate creativity; and informal or fun spaces, possibly including games, to facilitate team level support for creativity.

Sailer (2011) documents the importance of spaces with specific purposes while studying a UK media company before and after a relocation. She concludes that the main requirement for creativity is the ability to have a balance between spaces for communication and spaces without disturbances for individual concentration. This study also determines that bringing people together is important to enhance creativity, both in formal settings such as meeting rooms and in informal and spontaneous settings and between department boundaries.

Another study, conducted by Lee (2016), further documents the importance of additional spaces and aesthetics through in-depth structured interviews with creative employees from 22 start-up organisations in Michigan. *Table 6.3.4* summarises seven features that were found to promote creativity, based upon how people work during different phases in their individual creative processes.

*Table 6.3.4, Characteristics of the Physical Work Environment that can Foster Creativity, as discussed by Lee (2016).*

<b>Characteristic</b>	<b>Description and Attributes</b>
<i>Disengaged Space</i>	Space for a short mental break individually or to build camaraderie. Can include play spaces, solitude spaces and social hangout spaces.
<i>Doodle Space</i>	Spaces for idea generation through tasks such as brainstorming, sketching, model making or roleplaying. Can include formal, informal or impromptu meeting spaces.
<i>Unusual / Fun Atmosphere</i>	Spaces to inspire a creative mental state. Can include stimulating art/design/craft work, unusual or fun interior or decorative objects and stimulating architectural and interior design elements.
<i>Relaxing Environment</i>	Spaces that reduce stress and promote health and well-being through relaxation. Can include natural elements or a home-like setting.
<i>Stimulating Senses</i>	Spaces that stimulate the human sensory systems. Can include olfactory, auditory and visual elements, such as pleasant smells, music or stimulating colours.
<i>Technology Interface for Collaboration</i>	Spaces that allow access to information and group sharing, creation and display of information. Can include manual and low-tech solutions such as pin up boards, or electronic and high tech solutions such as audio-visual display tools.
<i>Balanced Layout</i>	Spaces that support effective work flow as well as different modes of working, such as collaborative vs. individually focused. Can include flexible and open space, spaces for communication, and spaces with visual and acoustical privacy.

This study also investigates these characteristics perceived criticalness or importance to creative outcomes and their practicality to implement for both workplace professionals and an organisations CEO or founder. While there was relatively little deviation between the importance of most characteristics, the workplace professionals placed substantially less value on layout (spaces supporting effective workflow or collaborative or individually work) than leadership.

The final compilation of elements of the physical workplace that is documented to promote or inhibit creativity is that constructed by Kallio et al. (2015) and as discussed within the summary of this article in Chapter 5. These findings are outlined in *Table 6.3.5*.

*Table 6.3.5, Features of Physical Space that can Inhibit or Promote Creativity, Compiled from Kallio et al. (2015).*

Feature of Physical Space	Inhibiting Creativity	Promoting Creativity
<i>Location</i>	Traditional, limits organisational culture.	Edgy, creating a forward looking identity.
<i>Number of Floors</i>	Multiple floors, limiting interactions and communication.	Less floors, increasing a sense of belonging, collectively, equality and openness.
<i>Division of space</i>	Long corridors, narrow stairs and small elevators. Employees spread over several locations.	Open spaces and wide corridors and stairs provide openness and facilitate free information flow and collectiveness
<i>Interdepartmental Division of Space</i>	Separation through walls / floors.	No physical division between departments.
<i>Intradepartmental Division of Space</i>	Separation through partitions	Functions sharing mutual open spaces lead to enhanced information flow, fewer emails and more spontaneous meetings.
<i>Break Facilities</i>	Formal / hierarchal spaces, departmental break facilities	Collective, inclusive and informal spaces. Increased spontaneous interaction.
<i>Aesthetics</i>	Worn out and dated interiors, conservative art, small windows. Detracts from company image.	Unconventional and playful decor, a sense of history, high ceiling height. Creates feelings of appreciation, togetherness, openness and equality, and contribute to a forward-looking image
<i>Status Symbols</i>	Administrative corridor, large private offices for upper management, conservative design and decor.	Equality. No visible status symbols, standard workstations, desks, computers, and chairs for everyone.

This study uncovers several unique attributes. Firstly, the division of space is documented to be central in the creation of an organisational climate conducive to creativity, both in terms of floors, walls and partitions, and in terms of departments. Secondly, location as a whole is documented to influence creative performance. Similar findings were found in a study conducted on British creative worker by Drake (2003), where locality was shown to impact the design process. Finally, this study by Kallio et al. (2015) looks at the symbolic value of physical elements, such as those like private offices and conservative décor that designate status. Elements that reinforce workplace status were seen to inhibit organisational creativity, while standardised workstations and physical elements that reinforce equality were thought to promote creativity.

## Summary

Through analysing the literature sources it is evident that there are many varied conditions or elements of the physical workplace that have been documented to promote or inhibit creativity. Arguably most importantly are some basic working conditions that need to be met for creative work to occur, such as light, temperature, sound, ergonomic furniture and sufficient space. Many of these factors have also been documented to be central for productivity, as discussed in Chapter 2. Secondly, a variation of spaces has been shown to promote organisational creativity, ideally balancing team and private spaces, and designated spaces for working and relaxation or fun. Finally, an overall level of aesthetics and interior design has been frequently documented to support workplace creativity, particularly at the organisational level where these conditions become symbolic of an innovative and creative workplace.

While the results are varying, there are relatively few contradictions between different studies. Discrepancies are present when, for example, both calming and inspiring colours or both private individual and open team spaces are required to support creativity. This often occurs within a single study and is linked to the subjective and dynamic nature of creativity. For example, some tasks may require individual work, while others can be best conducted in a group or open setting.

Despite the rational approaches of instrumental studies such as those conducted by Dul and Ceylan (2011, 2014) and Lukerman & Burgess-Limerick (2013), it is possible to also see symbolism at play within these sources. It is the socially created standards and conventions that have dictated what a desirable and creativity supporting physical setting is, and it is perhaps how employees perceive their surrounding that is of more importance than how the physical environment actually is. For example, the impact of inspiring or calming colours is arguably based upon the inherent values or assumptions the employees have and what the colours symbolise for the workplace, rather than that a particular wall colour in itself influences creative outcomes. This symbolism that is present even within outwardly instrumental studies creates a type of dualism. We see that many elements of the physical workplace act to directly promote or inhibit creativity in instrumental studies, and at the same time indirectly influence creativity by acting as important symbols demonstrating the organisations status as innovative.

## 7. Conclusions

This thesis has investigated the relationship between workplace creativity and the physical work environment, looking at the conditions that are considered to promote or inhibit organisational creativity. The concepts of creativity and the physical work environment are multifaceted and subjective, and a literature review was chosen as the method of this thesis in order to navigate this complexity and explore a wide variety of sources. A comprehensive search and selection process based upon a feature map identified 18 peer-reviewed journal articles.

While research designs and assumptions varied significantly across the collected material, it was unanimously documented that the physical work environment can influence creativity. Despite articles indicating both direct and instrumental relationships (e.g. Dul and Ceylan, 2014) and symbolic relationships of indirect influence (e.g. Kallio et al., 2015), all articles are a product of the contemporary organisational environment that they have been produced in and the inherent assumptions that this contains. This complexity makes it difficult to ascertain if a relationship between the physical office environment and creativity have been documented to exist because it has been proven to do so in practise, or because it is normally accepted to do so. An organisation can both make the rational decision to support creative work through the office setting in an effort to realise goals, and as a symbolic gesture to follow current organisational fashions and contribute to the legitimacy and success of the business as a whole.

Many specific conditions and elements of the physical workplace have been documented to promote or inhibit creativity with this literature selection. Firstly those that govern basic working conditions that need to be met for creative work to occur, such as light, temperature, sound, ergonomic furniture and sufficient space. Secondly, a variation of spaces has been shown to promote organisational creativity, ideally balancing team and private spaces, and designated spaces for working and relaxation or fun. Finally, an overall level of aesthetics and interior design has been frequently documented to support workplace creativity. These qualities function on both instrumental and symbolic levels. Some elements, like temperature or smell, appear to function in a similar way across most organisations to either promote or inhibit creativity, and are predominantly instrumental, while other qualities such as aesthetics are recognised to function at a figurative level, as important as symbols to

represent that an organisation is creative. Primarily, however, a duality is present where many elements of the physical workplace work to directly promote or inhibit creativity, and at the same time are equally important as symbols to embody that the organisation is creative and innovative.

Methodological weaknesses within this thesis are predominantly related to the analysis of sources, where my own perceptions and assumptions have shaped both the selection of material discussed and the conclusions made. This limits the reliability of this literature review, and is an inherent problem with compiling qualitative data. The conclusions drawn must therefore be seen in light of my background within both architecture and organisational studies.

Several articles within the literature selection have called for further research to replicate their studies at a larger scale (eg. Dul and Ceylan, 2014; Haner, 2005; Malinin, 2016), possibly across different industries or geographical locations. While this would present interesting material, and potentially further validate several of the conclusions of this thesis, my own interpretation is that new research should focus on developing a language to discuss the combined concepts of creativity and the physical workplace setting. This language must be able to encompass and differentiate between instrumental and symbolic assumptions, and allow for subjectivity, inconsistencies and immeasurable values. It is only after a reliable dialogue has been established between the concepts of the physical workplace environment and creativity that their relationship can be holistically studied.

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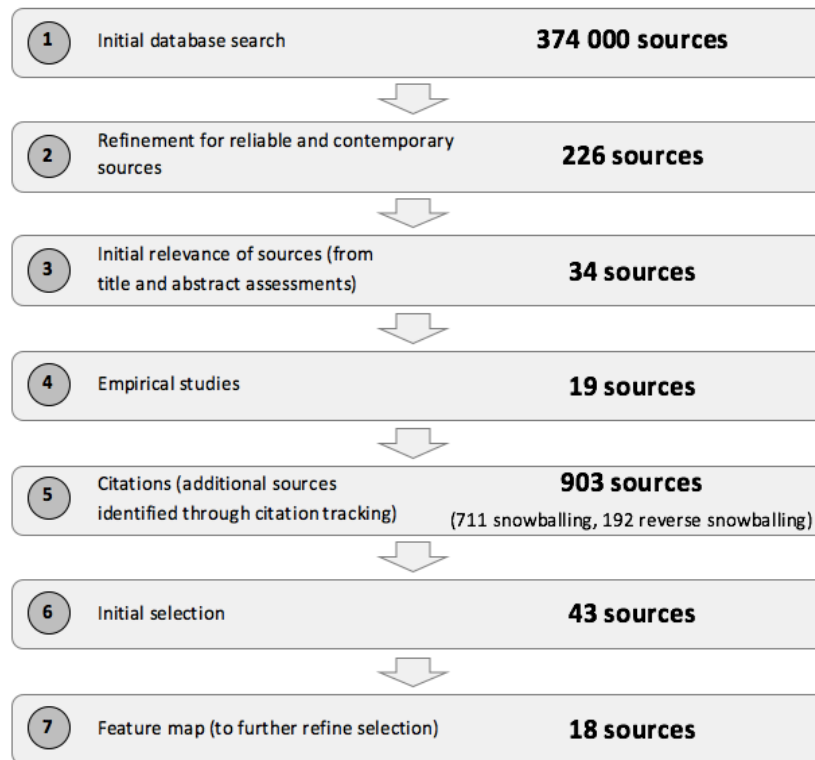
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## 9. Appendix

**Appendix Table 1: The Literature Selection Process**



**Appendix Table 2: Key Terms for Database Search**

	<i>Creativity</i>	<i>The Physical Work Environment</i>
<i>Initial search terms</i>	Creative, creativity, innovation	Physical work environment, physical setting, physical context, work environment, workplace, office interior, interior design, interior architecture, office design
<i>Additional search terms</i>	Organisational creativity, creative outcomes, creative results, innovative results	Spatial planning, room design, rooms, ancillary spaces, open plan, open plan offices, traditional office design, office size, office complexity, building design, building complexity, privacy, light, lighting, natural lighting, artificial lighting, daylight, windows, view, nature view, materials, natural materials, colours, interior elements, architectural elements, furniture, furnishings, plants, flowers, aesthetic objects, interior decorations, ambient conditions, sounds, smell, temperature, air quality

**Appendix Table 3: Feature map/ Questionnaire, as discussed in Chapter 4.4.**

Question	Notes
<b>Part 1: General Information</b>	
1 Author/s	-
2 Year of publication	Ranging from 1992 - 2017
3 Title	-
4 Publication medium	Journal, book, thesis etc.
5 Publication name	E.g. Journal name
6 Location / country	Place of research / institution, or place of publication if unavailable.
7 Discipline	E.g. Psychology, management, architecture, etc.
<b>Part 2: Reliability</b>	
8 SJR Journal H-index	Typically ranging from about 20 - 200
9 Google scholar author H-index	Typically ranging from about 0 - 100
10 Number of citations within source	-
11 Cited by (BIBSYS)	-
12 Institutions involved in study	E.g. university name
13 Author duplicity	Has the same author/s contributed to multiple selected sources?
<b>Part 3: Relevance</b>	
14 Purpose of literature source	-
15 Is this purpose objective or subjective?	-
16 Relevance to the physical working environment as a whole	-
17 Relevance to particular features of the physical working environment	-
18 Relevance to organisational creativity	-
19 How is creativity defined within the article?	-
20 At what level is creativity discussed or studied?	E.g. at an individual, team or organisational level
<b>Part 4: Method / Research Design</b>	
21 Is the study empirical?	Extent of empiricism
22 Is the study qualitative or quantitative?	Or a combination of both, triangulation, etc.
23 What is the research type?	Descriptive, case study, correlational, experimental, review, meta-analytic or other.
24 What is the grouping/time frame of the study?	Cross sectional, cohort, longitudinal, other. Studied over a long or short period.
25 In which year was the study conducted?	Ranging from 1992 - 2017
26 What are the methods of data collection?	Observation, survey, structured/non structured interviews.
27 How is the variable of the physical environment measured?	Quantitatively or qualitatively?
28 How is the variable of creativity measured?	Quantitatively or qualitatively?
29 Is the publication deductive, inductive or adductive?	-

<b>Part 5: Organisations in Study</b>		
30	Number	-
31	Response rate	-
32	Locations	Areas/state and country
33	Sizes	Number of employees
34	Branch / industry	Variation or constant in study
35	Sector	Public or private
36	Selection criteria	-
<b>Part 6: Theoretical Background</b>		
37	Does the literature discuss a theoretical basis for the research?	-
38	What theoretical assumptions are described within in the literature?	-
39	What inadvertent theoretical assumptions are present in the literature?	-
40	Can the article be considered to be based upon instrumental or symbolic ideologies?	Or both / a combination.
<b>Part 7: Results</b>		
41	Does the literature answer part one of the research question?	<i>Is it documented that the physical workplace environment influences creativity?</i>
42	Does the literature answer part two of the research question?	<i>What conditions or elements of the physical workplace are believed to promote or inhibit creativity?</i>
43	In the literature, what results are emphasized?	-
44	How are these results explained and accounted for?	-
45	What originality or new results does this study have?	-
46	What limitations does this study have?	-
47	Relevance to organisational creativity	-

**Appendix Table 4: Initial Literature Selection, as discussed in Chapter 4.4.**

Author(s)	Year	Title	Published in	Journal H-index (SJRI)	Author H-index (GS)	Citations	Cited by (BS)	Empirical	Identified through	Assessment
Amabile et al.	1996	Assessing the work environment for creativity	Academy of Management Journal	266	n/a	71	250	No	Snowballing, Yeh & Huan 2017	Low relevance to physical environment
Ashkanasy et al.	2014	Understanding the physical environment of work and employee behavior: an affective events perspective	Journal of Organizational Behavior	142	(63) Ashkanasy	111	10	No	Reverse snowballing, McCoy & Evans 2010	Low relevance to creativity
Bisadi et al.	2012	Future Research Centers: The Place of Creativity and Innovation	Procedia - Social and Behavioral Sciences	34	2 (Bisadi) 10 (Hosseini)	35	0	Yes	Reverse snowballing, Dul & Ceylan 2011	Primary literature
Ceylan et al.	2008	Can the office environment stimulate a manager's creativity?	Human Factors and Ergonomics in Manufacturing	30	8 (Ceylan)	40	15	Yes	Snowballing, Dul et al. 2011	Primary literature
De Paoli & Ropo	2017	Creative workspaces – a fad or making real impact?	Journal of Corporate Real Estate	19	7 (Paoli) 20 (Ropo)	46	1	Yes	Reverse snowballing, Dul et al. 2011	Same empirical data as De Paoli et al. 2017
De Paoli et al.	2017	The spatial context of organizations: A critique of 'creative workspaces'	Journal of Management & Organization	25	7 (Paoli) 20 (Ropo)	81	1	Yes	Reverse snowballing, Dul et al., 2011	Primary literature
Drake	2003	'This place gives me space': place and creativity in the creative industries	Geoforum	90	n/a	46	132	Yes	Snowballing, Hoff and Öberg 2015	Low relevance to physical environment
Dul & Ceylan	2011	Work environments for employee creativity	Ergonomics	91	32 (Dul), 8 (Ceylan)	64	38	Yes	Snowballing, Dul et al., 2011	Primary literature
Dul & Ceylan	2014	The impact of a creativity-supporting work environment on a firm's product innovation performance	Journal of Product Innovation Management	119	32 (Dul), 8 (Ceylan)	99	8	Yes	Database search, Work environment	Primary literature
Dul et al.	2011	Knowledge workers' creativity and the role of the physical work environment	Human Resource Management	7	32 (Dul)	123	32	Yes	Database search, Physical environment	Primary literature
Haner	2005	Spaces for creativity and innovation in two established organizations	Creativity and Innovation Management	47	n/a	45	22	Yes	Snowballing, Hoff & Öberg 2015	Primary literature
Hemlin	2008	Creative knowledge environments	Creativity Research Journal	65	20 (Hemlin)	125	22	No	Snowballing, McCoy & Evans 2010	Low relevance to physical environment
Hoff & Öberg	2015	The role of the physical work environment for creative employees – a case study of digital artists	International Journal of Human Resource Management	89	n/a	37	2	Yes	Database search, Physical environment	Primary literature
Kallio et al.	2015	Physical space, culture and organisational creativity – a longitudinal study	Facilities	35	13 (Kallio, T) 6 (Kallio, K)	55	4	Yes	Reverse snowballing, McCoy & Evans 2010	Primary literature
Knasko, Susan	1992	Ambient odor's effect on creativity, mood, and perceived health	Chemical Senses	87	n/a	n/a	n/a	Yes	Snowballing, Dul 2011	Supplementary material, too specific
Kombeiz & Steidle	2018	Facilitation of creative performance by using blue and red accent lighting in work and learning areas	Ergonomics	91	2 (Kombeiz), 6 (Steidle)	n/a	n/a	Yes	Database search, Colours	Supplementary material, too specific
Kristensen	2004	The physical context of creativity	Creativity and Innovation Management	47	10 (Kristensen)	36	26	No	Database search, Physical context	Supplementary material, non-empirical
Lee	2016	Creative workplace characteristics and innovative start-up companies	Facilities	35	n/a	20	6	Yes	Database search, Workplace	Primary literature
Lewis & Moultrie	2005	The organizational innovation laboratory	Creativity and Innovation Management	47	19 (Moultrie)	14	21	Yes	Snowballing, Lee 2016	Primary literature
Lukerman & Burgess-Limerick	2013	The perceived importance and the presence of creative potential in the health professional's work environment	Ergonomics	91	10 (Lukersmith) 34 (B-L)	34	4	Yes	Reverse snowballing, Dul & Ceylan 2011	Primary literature
Malinin	2016	Creative practices embodied, embedded, and enacted in architectural settings: toward an ecological model of creativity	Frontiers in Psychology	90	3 (Malinin)	127	0	No	Reverse snowballing, McCoy & Evans 2010	Non empirical, useful diagrams
Martens	2011	Creative workplace: instrumental and symbolic support for creativity	Facilities	35	n/a	51	12	Yes	Database search, Workplace	Primary literature

Martins, Juliana	2015	The extended workplace in a creative cluster: exploring space(s) of digital work in silicon roundabout	Journal of Urban Design	34	n/a	n/a	n/a	n/a	n/a	Database search, Workplace	Supplementary material, too specific
McCoy	2005	Linking the physical work environment to creative context	Journal Of Creative Behavior	39	n/a	n/a	75	14	No	Database search, Physical environment	Non empirical, useful tables
McCoy & Evans	2010	The potential role of the physical environment in fostering creativity	Creativity Research Journal	65	91 (Evans)	39	43	Yes	Yes	Database search, Physical environment	Primary literature
Moultreie et al.	2007	Innovation spaces: towards a framework for understanding the role of the physical environment in innovation	Creativity and innovation management	47	19 (Moultreie)	62	26	No	No	Database search, Physical environment	Supplementary material, non-empirical
Oksanen & Stähle	2013	Physical environment as a source for innovation	Journal of Knowledge Management	90	23 (Stähle)	50	22	No	No	Database search, Physical environment	Supplementary material, non-empirical
Puccio et al.	2000	Examining creative performance in the workplace through a person-environment fit model	Journal of Creative Behavior	39	n/a	51	0	Yes	Yes	Database search, Workplace	Relevance, data from 1995
Pullen	2000	Flexibility in the workplace: instrumental or creative?	Journal of Corporate Real Estate	19	n/a	n/a	n/a	n/a	n/a	Database search, Open plan	Supplementary material, too specific
Sailer	2011	Creativity as social and spatial process	Facilities	35	13 (Sailer)	41	12	Yes	Yes	Reverse snowballing, Kristensen 2011	Primary literature
Samani et al.	2017	The influence of personal control and environmental distraction in open-plan offices on creative outcome	Performance Improvement Quarterly	14	5 (Samani)	n/a	n/a	Yes	Yes	Reverse snowballing, Dul & Ceylan 2011	Supplementary material, too specific
Samani et al.	2017	The effect of open-plan workspaces on behavior and performance among Malaysian creative workers	Global Business and Organizational Excellence	12	5 (Samani)	n/a	n/a	Yes	Yes	Reverse snowballing, Dul & Ceylan 2011	Supplementary material, too specific
Sheykhhan & Saghaei	2011	How physical and non-physical working environment affects creativity	Management Science Letters	n/a	n/a	11	1	Yes	Yes	Database search, Physical environment	Low reliability
Shibata & Suzuki	2004	Effects of an indoor plant on creative task performance and mood	Scandinavian Journal of Psychology	61	4 (Shibata)	n/a	n/a	Yes	Yes	Database search, Plants	Supplementary material, too specific
Steidle & Werth	2013	Freedom from constraints: darkness and dim illumination promote creativity	Journal of Environmental Psychology	102	6 (Steidle)	n/a	n/a	Yes	Yes	Database search, Lighting	Supplementary material, too specific
Stokols et al.	2002	Qualities of work environments that promote perceived support for creativity	Creativity Research Journal	65	63 (Stokols)	34	25	Yes	Yes	Snowballing, Dul et al. 2011	Primary literature
Toker & Gray	2008	Workspace planning and innovation in U.S. university research centers	Research Policy	191	n/a	53	28	Yes	Yes	Snowballing, Dul et al. 2011	Low relevance to creativity
Van Der Lugt et al.	2007	Future center 'The Shipyard': learning from planning, developing, using and refining a creative facility	Creativity and Innovation Management	47	14 (Van Der Lugt)	23	4	Yes	Yes	Reverse snowballing, Haner 2005	Primary literature
Vithayathawornwong et al.	2003	The role of the physical environment in supporting organizational creativity	Journal of Interior Design	8	n/a	39	19	Yes	Yes	Database search, Physical environment	Primary literature
Walter	2012	Work environment barriers prohibiting creativity	Procedia - Social and Behavioral Sciences	34	n/a	15	0	Yes	Yes	Reverse snowballing, Amabile 1996	Low relevance to physical environment
Woodman et al.	1993	Towards a theory of organizational creativity	Academy of Management Review	229	15 (Sawyer)	95	249	No	No	Snowballing, Ceylan, 2008	Low relevance to physical environment
Wycoff & Sneed	1999	Stimulating innovation with collaboration rooms	The Journal for Quality and Participation	n/a	n/a	0	2	No	No	Snowballing, Oksanen & Pirjo 2013	Low reliability
Yeh & Huan	2017	Assessing the impact of work environment factors on employee creative performance of fine-dining restaurants	Tourism Management	143	n/a	57	n/a	Yes	Yes	Database search, Work environment	Low relevance to physical environment





