

Designing Creativity-Enhancing Workspaces: A Critical Look at Empirical Evidence

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Abstract. In recent years, companies have increasingly focused on innovative workspaces to enhance employee creativity. These new workspace concepts break with conventional office designs. Google, Apple, and Facebook are typical examples of companies that have received considerable media attention for their unique workspaces. Nowadays, many other organizations deal with the challenge of designing such creativity-enhancing workspaces. In contrast to this high practical relevance, the literature lacks an overview reflecting the present state of research on how to design such work environments. To bridge this gap, we conduct a systematic literature review to draw a comprehensive overview of existing empirical research on creativity-enhancing workspaces. Empirical evidence shows that designing creative workspaces is by no means a trivial task, because the physical work environment can both enhance and inhibit creativity in organizations. We categorize characteristics of creative workspaces and offer insights into how workspaces should be designed so that they foster creativity. Finally, we derive implications for both theory and practice, and conclude with suggestions for future research.

Keywords. creativity · workspace · workplace · physical work environment · literature review

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1. Introduction

There is widespread agreement that creativity and innovation are determinants of a firm's performance, success, and long-term survival (Amabile, 1996; Anderson, Potočnik, & Zhou, 2014; Bharadwaj & Menon, 2000; Woodman, Sawyer, & Griffin, 1993). In fact, creativity is not an individual trait, but can be enhanced and developed (Ripple, 1989). Firms have recognized this phenomenon and increasingly offer their employees innovative workspaces to stimulate their creativity. These new workspace concepts break with conventional office designs. Google, Apple, and Facebook are typical examples of companies that have received considerable media attention for their workspaces. Whereas these examples represent only some of the first firms that implemented creative workspaces on a large scale, nowadays many other organizations are concerned with the challenge of designing such new workspaces.

How to design an optimal workspace for employees — or physical work environment (PWE), as we call it in accordance with prior literature — is not a novel issue, but one that has already been widely discussed in recent decades (e.g. Block & Stokes, 1989; Goodrich, 1986). Literature on PWEs has revealed its various effects on employee behavior in the form of productivity (e.g. Larsen, Adams, Deal, Kweon, & Tyler, 1998) and efficiency (e.g. Veitch & Gifford, 1996). In this context, several authors have also investigated PWEs' influence on variables related to creativity. These include interaction and collaboration (e.g. Elsbach & Bechky, 2007; Hatch, 1987; Oldham & Brass, 1979; Oldham & Rotchford, 1983), communication (e.g. Allen, 1977; Allen & Henn, 2007; Boutellier, Ullman, Schreiber, & Naef, 2008), organizational culture (e.g. Kallio, Kallio, & Blomberg, 2015), and mood (e.g. Knez, 1995; Kim & de Dear, 2013; Stone, 1998; Sundstrom, Herbert, & Brown, 1982).

Based on these findings, researchers have realized that the PWE may also impact creativity directly (e.g. George, 2007; Shalley & Gilson, 2004). As an early example, Amabile (1996, p. 249) suggested to enhance creativity by creating "physical environments that are engineered to be cognitively and perceptually stimulating". Indeed, several studies empirically investigating the relationship between the PWE and creativity have been published over the last few years. These studies examine the PWE's influence on creativity from multiple angles and apply various research methods. However, findings are multitudinous, and, up to now, there is no comprehensive overview reflecting the present state of research in this field.

Therefore, the aim of this paper is to draw a comprehensive overview of existing empirical research on creativity-enhancing workspaces. The remainder of this paper is structured as follows: The next section briefly explains the concept of creativity and shows its role in the organizational context. Subsequently, we describe the procedure of the systematic literature review, and present and discuss the results of this review. Finally, we provide implications for both theory and practice, outline the studies' limitations, and reveal future research avenues.

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2. Theoretical background

Creativity is increasingly being recognized as a critical ability by which individuals and organizations create significant, sustainable value in today's rapidly changing environment (Amabile, 1988; Zhou & George, 2001). The process of creativity leads to novel and useful products, ideas, and processes (Amabile, 1988; Woodman et al., 1993). Therefore, creativity enhances an organization's ability to respond to opportunities and, thereby, to adopt, innovate, grow, and compete (Klein & Sorra, 1996; Pitta, Wood, & Franzak, 2008; Van de Ven, 1986).

Several perspectives exist to capture the nature of what creativity is. While several authors define creativity as an individual characteristic (e.g. Findlay & Lumsden, 1988) or a process (e.g. Rogers, 1954; Wallas, 1926), most researchers and theorists have adopted a definition that focuses on the product or outcome of a product development process that is both novel and valuable (Shalley, 1991; Woodman et al., 1993). In this context, creativity can also reflect the ability of an organization to produce such output (Amabile, 1988; Sternberg, 1988). Yet, organizational creativity is not predetermined by each employee's individual creativity; rather, it can actively be influenced by different parameters (Oldham & Cummings, 1996). Woodman et al. (1993), for example, summarize how creativity can be influenced at an individual level, team level, and organizational level.

Regarding the organizational level, several studies emphasize the influence of the work environment on creativity (e.g. Amabile, 1997; Woodman et al., 1993). Generally, the work environment consists of two components: the social work environment (SWE) and the PWE. Multiple authors have investigated the impact of the SWE: creativity is influenced by organizational climate (e.g. Ekvall, 1996; Tesluk, Farr, & Klein, 1997), leadership style (e.g. Howell & Boies, 2004; Zhang & Bartol, 2010), collaboration (e.g. Abra, 1994; Rickards, Chen, & Moger, 2001), and structures within the organization (e.g. Damanpour, 1996). Moreover, Amabile, Conti, Coon, Lazenby, and Herron (1996) as well as Ekvall (1996) developed instruments to assess the SWE for creativity. In contrast, there are few articles empirically assessing the role of the PWE for creativity. Nonetheless, these findings are important to managers who want to design creativity-enhancing workspaces. Against this background, we present a systematic literature review, aiming at discovering and synthesizing what empirical research has found so far regarding the optimal design of the PWE for fostering creativity in organizations.

3. Methodology

This literature review followed a systematic process based on Tranfield, Denyer, and Smart's (2003) procedure. At first, we deepened our understanding of the literature in the field. For this purpose, we scanned articles that we found in the Google Scholar and EBSCOhost databases that were relevant in the context of creative workspaces at first glance. Based on this initial search, we identified the following keywords to be likely contained in studies suitable for further investigation: "creativity" and "innovation" as dependent variables, and "physical workplace", "workspace", "physical work environment", "office layout", and "office design" as PWE synonyms. Considering these keywords, we derived search terms for both titles and abstracts to search for all relevant articles (see Table 1).

As search databases, we used EBSCOhost, ProQuest/ABI, and Google Scholar. Given the relatively narrow scope of the focal topic, we did not restrict our search to a given period or to a particular set of disciplinary journals. However, following the suggestion of Podsakoff, Mackenzie, Bachrach, and Podsakoff (2005), we limited our sample to peer-reviewed articles because these can be considered as validated knowledge and are likely to have the highest impact in the field. After removing duplicates, searching for the keywords in abstracts and titles yielded 262 articles from EBSCOhost, 209 articles from ProQuest/ABI, and 38,700 articles from Google Scholar. For Google Scholar, we only investigated the first 350 entries. Table 1 shows the number of unique entries for each search string and database.

Table 1. Search terms and number of entries in each database

Database	Search string	Search in	No. of entries
EBSCOhost	("creativ*" OR "innov*")	abstract	262 ¹
	AND ("work" OR "workplace*" OR "workspace*" OR "office*") AND ("environment" OR "design" OR "layout" OR "concept") AND ("physical")		
ProQuest/ABI	("creativ*" OR "innov*")	abstract	209 ¹
	AND ("work" OR "workplace*" OR "workspace*" OR "office*") AND ("environment" OR "design" OR "layout" OR "concept") AND ("physical")		
Google Scholar	("creativ*" OR "innov*") AND ("work" OR "workplace*" OR "workspace*" OR "office*") AND ("environment" OR "design" OR "layout" OR "concept") AND ("physical")	n/a	38,700 ²

¹ After removing duplicates from the results

² The first 350 entries were investigated.

To further narrow the pool of relevant articles for this study, we defined more detailed inclusion criteria. According to the aim of our study, we limited our sample to empirical studies investigating creativity and/or innovation as dependent variables while, at the same time, examining the influence of the PWE on these variables. Therefore, articles investigating, for example, only the SWE were excluded. These inclusion criteria were applied on the articles found by using a three-stage screening procedure (see Figure 1). First, we examined the titles and abstracts of all papers that we found through the database search. Removing articles that did not match the inclusion criteria led to 21 articles. Second, we read the full text of these 21 articles. This resulted in another nine articles that did not match our inclusion criteria. Third, we applied a snowball method and an analysis of cross-references between researchers complementarily in order to avoid further disregarding potentially relevant studies that we did not find through our initial search strategy. This resulted in a final sample of 17 articles.

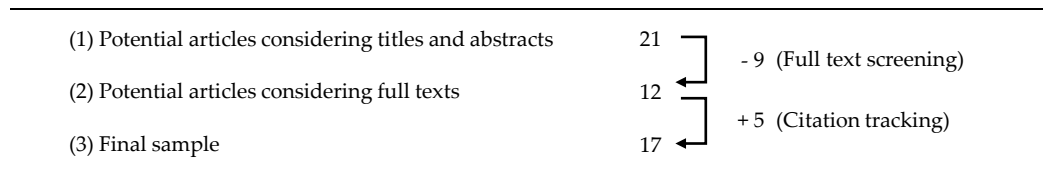


Figure 1. Number of articles in screening procedure

4. Results

4.1. Sample description

Empirical evidence for creativity-enhancing PWEs was found in multiple research fields. The relevant articles appeared in 13 different journals, and one article was published in the proceedings of an academic conference. Table 2 shows their distribution among the journals. According to the aim and scope of these journals, our sampled articles cover five distinct research fields: *creativity and innovation management, architecture and design, human resource management, ergonomics, and psychology*.

Table 2. Number of articles per journal and topic

Research field	Journal	No. of articles
Creativity and innovation management	<i>Creativity and Innovation Management</i>	2
	<i>Creativity Research Journal</i>	2
	<i>Journal of Creative Behavior</i>	1
	<i>Journal of Product Innovation Management</i>	1
	<i>Research Policy</i>	1
Architecture and design	<i>Facilities</i>	2
	<i>Int. Sociological Association (ISA): XVI World Congress of Sociology</i>	1
	<i>Journal of Interior Design</i>	1
Human resource management	<i>International Journal of Human Resource Management</i>	1
	<i>Human Resource Management</i>	1
Ergonomics	<i>Ergonomics</i>	1
	<i>Human Factors and Ergonomics in Manufacturing</i>	1
Psychology	<i>Journal of Environmental Psychology</i>	1
	<i>Scandinavian Journal of Psychology</i>	1

Over the last 20 years, the topic of creativity-enhancing workspaces has attracted continuous interest in academia. While most of the 17 articles focused primarily on the influence of the PWE on creativity, two articles examined work environments on a more general level by putting stronger emphasis on SWE. Nevertheless, we included both articles in our review since they also investigated elements of the PWE. All of the articles investigated positive effects on creativity, and three articles additionally examined negative effects on creativity. Table 3 gives an overview of the examined articles.

Regarding the dependent variable, studies investigated the effect of the PWE on creativity on three levels: *individual level creativity, team level creativity, and organizational level creativity*. Most articles analyzed effects at the individual level. Out of these, two studies additionally examined creativity on a team level: Haner (2005) examined the creative potential of the physical workspace for individuals as well as teams in two established organizations, and Magadley and Birdi (2009) compared creative performance between individuals and teams in an innovation lab with their creative performance in standard PWEs. Four articles analyzed the influence of the PWE on organizational creativity. Among these, two articles investigated the creative potential of the PWE in companies especially recognized for their innovativeness (Lee, 2016; Vithayathawornwong, Danko, & Tolbert, 2003). The other two articles (Dul & Ceylan; 2014; Toker & Gray, 2008) examined the PWE’s influence on an organization’s creative performance as measured, for example, by the number of innovation-related items, including the number of books and written papers.

Table 3. Overview of examined articles

#	Year	Author(s)	Journal	Focus on PWE	Hypothesized effect direction		Level of analysis		
					Positive	Negative	Individual	Team	Organization
1	1997	Alencar & Bruno-Faria	<i>Journal of Creative Behavior</i>	No	x	x	x		
2	2002	McCoy & Evans	<i>Creativity Research Journal</i>	Yes	x	x	x		
3	2002	Stokols, Clitheroe, & Zmuidzinas	<i>Creativity Research Journal</i>	No	x	x	x		
4	2003	Vithayathawornwong, Danko, & Tolbert	<i>Journal of Interior Design</i>	Yes	x				x
5	2004	Shibata & Suzuki	<i>Scandinavian Journal of Psychology</i>	Yes	x		x		
6	2005	Haner	<i>Creativity and Innovation Management</i>	Yes	x		x	x	
7	2006	Steiner	<i>ISA: XVI World Congress of Sociology</i>	Yes	x		x		
8	2008	Ceylan, Dul, & Aytac	<i>Human Factors and Ergonomics in Manufacturing</i>	Yes	x		x		
9	2008	Toker & Gray	<i>Research Policy</i>	Yes	x				x
10	2009	Magadley & Birdi	<i>Creativity and Innovation Management</i>	Yes	x		x	x	
11	2011	Dul & Ceylan	<i>Ergonomics</i>	Yes	x		x		
12	2011	Dul, Ceylan, & Jaspers	<i>Human Resource Management</i>	Yes	x		x		
13	2011	Martens	<i>Facilities</i>	Yes	x		x		
14	2013	Steidle & Werth	<i>Journal of Environmental Psychology</i>	Yes	x		x		
15	2014	Dul & Ceylan	<i>Journal of Product Innovation Management</i>	Yes	x				x
16	2015	Hoff & Öberg	<i>Int. Journal of Human Resource Management</i>	Yes	x		x		
17	2016	Lee	<i>Facilities</i>	Yes	x				x

Table 4 summarizes the different dependent variables that were found in the examined studies and the respective measurement methods. In this regard, the 17 articles can be differentiated into two groups: articles that considered the *creative potential of an office environment* as the dependent variable and articles that examined actual *creative performance*. The only exception is the study by McCoy and Evans (2002), which examined both the perceived creative potential and the creative performance of different workplaces.

Creative potential of the PWE was primarily measured through self-assessment. In three articles, however, creative potential was rated by experts. To measure creative potential by self-assessment, participants rated different PWEs shown on photographs (Alencar & Bruno-Faria, 1997; Ceylan et al., 2008; McCoy & Evans, 2002; Steiner, 2006), or they assessed their own physical workplace (Hoff & Öberg, 2015; Stokols et al., 2002; Vithayathawornwong et al., 2003). Studies that used expert assessments conducted either interviews (Martens, 2011) or surveys (Lee, 2016).

The dependent variable *creative performance* was self-assessed in five articles. In these studies, participants rated their creative performance by means of tasks and interviews (Magadley & Birdi, 2009) or by answering surveys with appropriate items (e.g. Toker & Gray, 2008). Three studies used creativity tasks to evaluate creative performance (e.g. "Generate up to 30 words associated with each of the listed adjectives.").

Table 4. Categorization and measuring methods of dependent variables

Measurement of dependent variable	Dependent variable	
	Creative potential of the PWE	Creative performance
Self-assessment	1, 2, 3, 4, 7, 8, 16	9, 10, 11, 12, 15
Rated by experts	6, 13, 17	
Task results		2, 5, 14

Note: The numbers refer to the article numbers presented in Table 3.

4.2. Categorization of PWE characteristics

Regardless of the level of analysis, various creativity-influencing parameters of the PWE were identified and categorized. The aim of this categorization was to achieve a clear overview of the so far examined physical characteristics that influence employees'

creativity. Therefore, we proceeded as follows: First, we analyzed and coded the content of each article (Miles, Huberman, & Saldaña, 2014). This resulted in 34 different specifications of the PWE. In the next step, we collapsed similar specifications, resulting in 20 distinct characteristics of the PWE. Finally, we clustered the characteristics into three categories that seemed internally most homogeneous and externally most heterogeneous and named them in correspondence to the characteristics they consist of: *office elements*, *spatial layout*, and *space types*.

The category *office elements* includes two sub-categories, depending on the elements' tangibility. First, *intangible office elements* comprise sound, colors, light, temperature, and smell in the workplace. *Tangible office elements* include furniture, plants, office equipment, the presence of a window/view, decorative elements, and materials and surfaces. The *spatial layout* represents the general arrangement of the physical workspace (i.e. privacy, flexibility/customization/balance, office layout, office size, and complexity). Finally, the category *space types* describes four specific kinds of physical workspaces for different work modes: relaxing, doodle, disengaged, and unusual/fun spaces.

Table 5 shows the three identified PWE categories and their associated elements. In the following, we describe the findings on each category's impact on creativity. It is important to mention that the proposed categories are based on existing empirical findings. Thus, it should not be understood as an encompassing, final framework of PWE design possibilities.

Table 5. Categories and characteristics of the PWE influencing creativity

Categories of the physical work environment	No. of studies	Studies
Office elements	16	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17
<i>Intangible office elements</i>	13	1, 2, 3, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17
Sound	9	1, 3, 7, 11, 12, 13, 15, 16, 17
Colors	9	2, 6, 7, 8, 11, 12, 15, 16, 17
Light	8	1, 2, 6, 11, 12, 14, 15, 16
Temperature	5	1, 11, 12, 13, 15
Smell	4	11, 12, 15, 17
<i>Tangible office elements</i>	13	1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 15, 16, 17
Furniture	8	1, 2, 4, 8, 11, 12, 15, 16
Plants	7	5, 7, 8, 11, 12, 15, 16
Office equipment	6	4, 6, 8, 10, 16, 17
Window/view	6	2, 8, 11, 12, 15, 16
Decorative elements	2	2, 16
Materials and surfaces	2	2, 8
Spatial layout	14	1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17
Privacy	7	3, 6, 9, 11, 12, 15, 16
Flexibility/customization/balance	5	6, 7, 13, 16, 17
Office layout	5	4, 7, 9, 13, 16
Office size	4	1, 2, 4, 16
Complexity	2	2, 8
Space types	5	4, 7, 13, 16, 17
Relaxing space	4	4, 13, 16, 17
Disengaged space	4	4, 7, 16, 17
Doodle space	2	16, 17
Unusual/fun space	1	17

Note: The numbers in the right column refer to the article numbers presented in Table 3.

4.2.1. *Intangible office elements*

Sound. Sound can have positive as well as negative impacts on creativity. Noise levels that are too high diminish creativity. Interviews with workers (Alencar & Bruno-Faria, 1997; Stokols et al., 2002) and creative professionals (Hoff & Öberg, 2015; Martens, 2011) showed that environmental noise is distracting and therefore impedes creativity. In contrast, positive sound has the potential to increase creativity. In this context, Dul and colleagues (Dul & Ceylan, 2011, 2014; Dul et al., 2011) found music, silence, and the absence of noise as elements of the PWE that support creativity. In contrast, Steiner (2006) and Lee (2016) found no significant impact of positive sounds on creativity.

Colors. The selection of appropriate colors for workspace design also influences creativity (Steiner, 2006), but empirical results are contradictory. Generally, a room's color scheme can be differentiated into cool color designs (e.g. blue, green, or blue violet) and warm color designs (e.g. yellow, orange, or red). McCoy and Evans (2002) found that PWEs with primarily cool colors negatively influence creativity, whereas they found no stimulating effect of warm colors on creativity. However, Ceylan et al. (2008) found offices with mainly cool colors to enhance creativity, whereas they found offices with mainly warm colors as too stimulating and therefore inhibiting creativity. Based on these preliminary studies, Dul and colleagues (Dul & Ceylan, 2011, 2014; Dul et al., 2011)

focused on positive effects of colors on creativity and reported both warm and cool colors as enhancing creativity. Against this background, Haner's (2005) suggestion of using different colors for different phases of the creative process seems compelling. In particular, he proposes to execute divergent thinking activities in an environment with more warm colors, whereas cooler colors should be used to support the convergent phases of creative process. Moreover, Hoff and Öberg (2015) and Lee (2016) found that the effect of colors on creativity depends on individual perception. Nevertheless, they showed that sterile environments without colors have a negative impact on creativity.

Light. Different light settings can influence creativity. Again, findings in this context are contradictory. Most studies have indicated that good light supports creativity. In this context, adequate illumination is necessary for promoting creativity in the physical workspace, whereas insufficient light inhibits creativity (Alencar & Bruno-Faria, 1997; Ceylan et al., 2008). Moreover, current studies have found especially the exposure to daylight as creativity-supporting (Dul & Ceylan, 2011, 2014; Dul et al., 2011; Hoff & Öberg, 2015). Furthermore, interviews with digital artists showed that different tasks require different lighting settings (Hoff & Öberg, 2015). Contrary to these findings, Steidle and Werth (2013) showed in multiple experiments that darkness and dim illumination improve creativity, as participants felt less observed and controlled. Moreover, they found that participants in dim rooms performed better on creative tasks and worse on analytical tasks than participants in brighter rooms. Taken together, all above-mentioned studies show that consistent and controllable light is an important determinant for creativity. However, McCoy and Evans (2002) found neither the quantity (brightness) nor quality (even illumination) of light to influence creativity.

Temperature. The effect of temperature on creativity has also been investigated. In this context, some studies have found that adequate indoor climate (temperature, velocity, humidity, and composition of the air in the workplace) positively influences creativity (Dul & Ceylan, 2011, 2014; Dul et al., 2011). Interviews with workers (Alencar & Bruno-Faria, 1997) and creative experts (Martens, 2011) also showed that too high temperatures inhibit creativity.

Smell. The studies of Dul and Ceylan (2011, 2014) and Dul et al. (2011) found positive smell (e.g. fresh air, absence of bad smell) to stimulate creativity. However, Lee (2016) could not confirm that positive smell has an effect on creativity.

4.2.2. Tangible office elements

Furniture. Generally, authors agree that adequate furniture (e.g. chairs, tables, and cupboards) supports creativity. Alencar and Bruno-Faria (1997) showed that for being creative, office workers require an environment with furniture where they feel comfortable to stay for six to eight hours a day. Correspondingly, Dul and colleagues (Dul & Ceylan, 2011, 2014; Dul et al., 2011) confirmed the role of furniture as a creativity-enhancing element of the PWE. Moreover, Vithayathawornwong et al.'s (2003) survey in four different innovative organizations showed that furniture was one of the most frequently mentioned attributes of the PWE perceived to support freedom and therefore to enhance the organizational climate for creativity. Furthermore, McCoy and Evans (2002) found that furniture is an important contributor to the creative potential of the PWE because it can promote social interaction. In addition, Hoff and Öberg (2015) found ergonomic furniture (e.g. chairs and tables that can be adjusted to a standing position) and mobile furniture (e.g. chairs and tables with wheels) to positively influence creativity by improving the PWE in a functional manner. In contrast to these findings, Ceylan et al. (2008) could not find a significant effect of furniture on creativity.

Plants. All seven studies investigating the influence of plants on creativity confirmed that plants have a creativity-enhancing effect. Findings from Shibata and Suzuki (2004) showed that females' creative performance in an association task was significantly higher when a plant was in the room compared to when no object or a magazine stand was in the room. Similarly, Ceylan et al. (2008) showed that offices with plants are associated with high creative potential. Hoff and Öberg's (2015) interviews with creative professionals revealed the inspiring influence of plants by adding pleasant colors and natural elements to the PWE and, therefore, enhancing its creative potential. Moreover, Dul and colleagues (Dul & Ceylan, 2011, 2014; Dul et al., 2011) as well as Steiner (2006) found indoor plants and flowers to enhance creativity.

Office equipment. Equipping an office with appropriate tools can enhance creativity. On the one hand, these tools can be low-tech equipment, such as whiteboards and flip charts. On the other hand, high-tech equipment includes wireless connectivity or audio-visual display tools. For innovative start-up companies, Lee (2016) showed that both high-tech and low-tech office equipment is critical for teamwork, idea generation, and thus creativity in organizations. In one of the earlier studies, Vithayathawornwong et al. (2003) found supportive technologies that improve information and communication flows (e.g. e-mail and internet) as creativity-enhancing elements of the PWE. Ceylan et al. (2008) as well as Hoff and Öberg (2015) discovered that large screens, software, and computers are necessary tools for creativity, since computers are a useful source of information and facilitate controlled contact with colleagues. In a similar vein, Haner (2006) showed that providing IT and digital communication equipment enhances information-sharing, team collaboration, and, consequently, creativity. Moreover, findings from Magadley and Birdi (2009) showed that electronic idea generation software significantly fostered creativity compared to office settings without such high-tech equipment.

Window/view. Windows and views to outside the office can positively influence creativity. McCoy and Evans (2002) found that a view in general (visual access to any area outside the immediate setting) and a natural view (visual access to living plants, trees, or sky) strongly correlate with the perceived creative potential of an office. Consequently, offices with no view were associated with low creative potential. These results are consistent with the findings of Ceylan et al. (2008) and Hoff and Öberg (2015). Correspondingly, Dul and colleagues (Dul & Ceylan, 2011, 2014; Dul et al., 2011) confirmed that a view to nature and any window view foster creativity.

Decorative elements. McCoy and Evans (2002) were the first to find that decorative elements enhance the perceived creativity potential of workplace settings. The use of decorative elements leads to visually detailed environments in a way that, for example, personal items, books, artwork, and lamps enhance the complexity of visual detail. By asking creative professionals, the authors found that great creative potential lies in physical settings that are highly complex in visual detail. Hoff and Öberg (2015) further explained this by showing that decorative elements support creativity, because they inspire creatives in their daily work.

Additionally, Hoff and Öberg's (2015) interviewed digital artists perceived higher creative potential of the physical workspace when walls could be drawn on or decorated with artwork.

Materials and surfaces. McCoy and Evans (2002) also discovered that the various types of material employees are surrounded by in their workplace have an impact on creativity. In their study, manufactured and composite materials (e.g. plastic laminate, synthetic fibers, carpet, and steel) had a strong negative correlation with the perceived creative potential. In contrast, rooms with mainly natural elements (e.g. wood, marble, and leather) were perceived as environments with high creative potential. In particular, the authors found the texture of wood grain to have a positive impact. In contrast, Ceylan et al. (2008) could not confirm the influence of materials used in offices (natural as well as manufactured) on creative potential.

4.2.3. Spatial layout

Privacy. Privacy in the context of the PWE can influence creativity. We define privacy as the possibility of being secluded from the presence or view of others, whereas visibility is the counterpart. Dul and colleagues (Dul & Ceylan, 2011, 2014; Dul et al., 2011) and Stokols et al. (2002) found privacy to positively influence individual creativity, since individuals need to concentrate to be creative. In contrast to these findings, Toker and Gray (2008) showed that visibility among team members promotes face-to-face interactions, which enhance creativity and innovation performance. Other authors found both privacy and visibility as essential requirements for creativity. Haner (2006) as well as Hoff and Öberg (2015) state that both privacy and visibility are useful depending on the phase of the creative process. Whereas privacy supports individual creativity through concentrated work, being visible enhances team creativity.

Flexibility, customization, and balance. These attributes include the possibility of the workspace to be flexibly arranged for different work modes (*flexibility*), to be individually equipped with personal elements (*customization*), and to offer a balanced work setting between interaction and privacy (*balance*). Steiner (2006) and Martens (2011) found that flexible office concepts and customization of the workplace (e.g. different spatial settings for concentration and communication or control over the required level of solitude, interaction, and temperature) enhance creativity. Correspondingly, Hoff and Öberg (2015) found flexible PWEs (e.g. sliding doors and walls, or moveable partitions) that support both autonomous and collaborative needs to offer high creative potential. Furthermore, their findings showed that the ability to customize and personalize the workspace fosters creativity. Haner (2006) and Lee (2016) showed that balanced PWEs enhance creativity, since both social interaction and privacy are supported.

Office layout. Office layout means the overall arrangement of the individual workplaces. It can be distinguished between different office concepts, including open-plan offices, separated individual offices, or combinations of both. Generally, Vithayathawornwong et al. (2003) found that the office layout has an impact on dynamism as well as on freedom in the workplace, and eventually on creativity. By examining different university research centers, Toker and Gray (2008) found that territorially segregated research centers provided lower innovation outcomes than research centers that were territorially interconnected. This was due to the fact that interconnected spaces provided higher information exchange among scientists through face-to-face consultations. Correspondingly, Hoff and Öberg (2015) as well as Martens (2011) found that open office layouts, where managers and employees work together, facilitate communication and diffusion of ideas, thereby enhancing creativity. Moreover, Steiner (2006) showed that having either open-plan offices or individual offices offers less support for organizational creativity than combined office layouts. Instead, he found flexible office concepts to positively impact creativity.

Office size. The size of the workplace can positively and negatively influence creativity. Vithayathawornwong et al. (2003) showed that enough space for small meetings in the office enhances creativity. Correspondingly, findings from Hoff and Öberg (2015) found that a PWE with high creative potential requires space for visits from colleagues, and space for working materials and tools. Moreover, they found a comfortable distance between employees to foster creativity. In turn, Alencar and Bruno-Faria (1997) found a lack of space as a characteristic of the PWE that hinders creativity. In contrast to these results, McCoy and Evans (2002) could not find a relationship between office size and the perceived creative potential of the workplace.

Complexity. Spatial complexity influences creativity, but empirical findings are ambiguous. Generally, the complexity of the PWE describes the amount of all structural elements, such as the number of different shapes and forms in the room. Ceylan et al. (2008) found that low office complexity offers high creative potential, because such simply designed environments facilitate concentrated thinking for producing novel and useful ideas. In contrast, McCoy and Evans (2002) showed that workspaces with high spatial and visual complexity are perceived as environments with high creative potential.

4.2.4. Space types

Relaxing space. Many modern office designs include relaxing spaces that aim to reduce stress and enhance well-being through relaxation. Findings from Steiner (2006) showed that relaxation areas are also effective for enhancing creativity. Moreover, Martens (2011) found that creative insights are more likely to occur in exclusive places for relaxation where freedom and control are deeply experienced. Similarly, Hoff and Öberg (2015) showed that chill-out areas enhance creativity through relaxation. Furthermore, a PWE with rooms to take a nap with couches and home-like settings foster well-being and creativity. However, although relaxing spaces have become increasingly important in the workspace, Lee (2016) found no evidence for their impact on creativity.

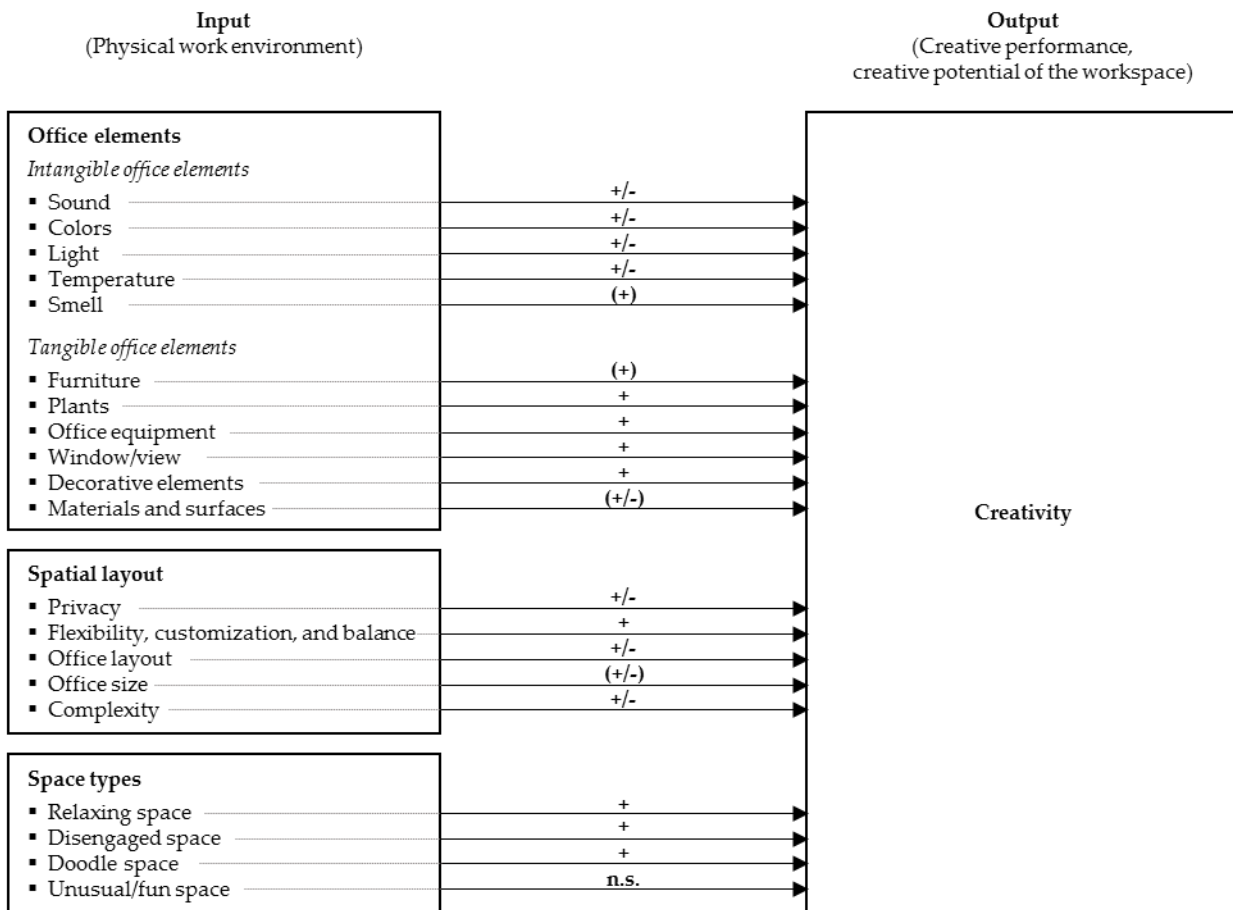
Disengaged space. Disengaged space is closely related to relaxing space, yet it is more than that. It provides possibilities for individual mental breaks through non-work-related activities with others, including play spaces for activities such as billiards and darts, or social hangout spaces, such as cafés and lounges. In his study with innovative start-ups, Lee (2016) found that disengaged space is the most important space type for creativity. Similarly, in the study of Vithayathawornwong et al. (2003), break areas for social interaction were the most frequently mentioned category of the PWE associated with freedom and creative potential. Hoff and Öberg's (2015) interviewed artists stated that informal social spaces (e.g. game rooms) promote bonding between employees and foster creativity. Correspondingly, Steiner (2006) named social hangout areas with coffee machines as the most important physical characteristic to support informal communication and creativity.

Doodle space. Doodle spaces provide possibilities for idea generation among employees, such as through brainstorming. According to Lee (2016), doodle spaces are places for (1) formal meetings (typically closed rooms with low-/high-tech tools), (2) intended but informal meetings (some doodling tools available), and (3) impromptu meetings (e.g. hallways). His findings show that doodle spaces are the most frequently incorporated PWE characteristic across 22 investigated start-up companies. Furthermore, Hoff and Öberg (2015) found that doodle spaces equipped with inspiring artifacts (e.g. toys) enhance creativity, since employees interact with the different elements in the room while talking and thinking.

Unusual/fun space. Unusual/fun spaces include fun or bizarre interior elements to inspire creativity. For example, such spaces include stimulating art and unconventional shapes and forms of windows, stairs, or ramps. Further characteristics of unusual/fun spaces are interior design elements, such as slides and swings; funky shapes and forms of walls, ceilings, and furniture; and unusual decorative objects (e.g. fun signage) and toys. Lee’s (2016) study with both CEOs and workplace professionals, however, found no direct effect of unusual/fun space on creativity.

5. Discussion

The aim of this literature review was to analyze existing empirical research on PWEs, aiming to understand how offices need to be designed to enhance creativity. In general, we found that the PWE can have a great impact on creativity within an organization. Based on prior empirical research, we identified three categories of the PWE that distinctively influence creativity. Figure 2 provides an overview of these categories and their corresponding characteristics.



Note: + = positive effect; +/- = positive and negative effects; n.s. = no significant effects; effects in brackets indicate tendencies.

Figure 2. Effects of PWE characteristics on creativity found in empirical studies

Some characteristics of the PWE consistently provided a positive influence on creativity. In this context, we found positive sound (e.g. background music, silence) and positive smell (e.g. fresh air) to support employees’ creativity. Additionally, the use of plants in the workspace and a view to nature promote creativity. These findings indicate that creating a pleasant work environment is an essential antecedent of employees’ creativity. Moreover, empirical evidence identified both low-tech as well as high-tech office equipment as creativity-enhancing PWE characteristics. This leads to the conclusion that handy equipment that can be used to stimulate work or thinking processes also has a positive effect on employees’ creativity. Additionally, decorating the workspace

with personal items supports their creativity. On this basis, we conclude that individualization of the workspace seems to be an important determinant of employees' creativity. Furthermore, balance between open and closed office layouts as well as flexible furniture positively influence creativity by allowing employees to work in private as well as in team settings. Finally, specific spaces for relaxation and social interaction among employees clearly foster creativity.

Researchers also agree that some characteristics of the PWE consistently provide a negative impact on creativity. Besides too much noise and too high temperatures, offices that are mostly made of composite and manufactured materials (in contrast to natural materials) hinder creativity.

Next to these unambiguous findings, there are elements of the PWE in which empirical findings showed incongruent effects on creativity. This is especially the case for colors, light, and the complexity of a space. A reason for the varying results may be that physical elements, such as light and color temperature, might have an optimal level at which creativity is enhanced most (Ceylan et al., 2008). Moreover, inconsistencies between results of prior studies may occur due to the high diversity of the examined articles in terms of participants, methodology, and environments. For example, studies by Haner (2006) and by Magadley and Birdi (2009) particularly focused on innovation laboratories, whereas Toker and Gray (2008) examined university research centers. Moreover, McCoy and Evans (2002) concentrated on educational environments with undergraduate students as study participants, whereas Ceylan et al. (2008) investigated office settings with managers as participants. This indicates that the effects of the PWE on employees' creativity are moderated by other variables, such as individual characteristics.

Another explanation for the incongruent findings among the articles might be induced by the varying measurement approaches of creativity. Many of the studies investigated not the quantifiable creative output in a PWE but the creative potential of a PWE. Additionally, in all of these studies, creative potential was self-assessed by the participants or rated by experts. In particular, studies examining space types were entirely based on subjective data of responses from creative professionals (Martens, 2011; Steiner, 2006), artists (Hoff & Öberg, 2015), and organizations (Lee, 2016; Vithayathawornwong et al., 2003). Thus, findings are primarily based on subjective and domain-specific data. Only three studies used creative tasks to examine creativity in the PWE, which are an appropriate method for quantifying actual creative performance (Silvia et al., 2008).

Against this background, we should acknowledge that even though empirical evidence is growing, we are still not able to answer all of the questions raised by practitioners and workspace designers. Moreover, by taking a critical look at what we have learned so far about creativity-enhancing workspaces, we cannot be finally sure if, for example, all of the effects revealed eventually resulted in increased creative employee performance or if they are only assumed to do so. In this context, the findings of this review offer a basic orientation and should serve as a basis for fruitful discussions and further research (we elaborate on this in the final section of this article).

Nonetheless, by examining the results of the analyzed studies, it becomes evident that studies in other contexts than in the field of creativity showed equivalent effects of PWE characteristics described here on other output variables than creativity. For example, PWEs with indoor plants and windows that we found to support creativity also affect mood and well-being (e.g. Hedge, 1982; Larsen et al., 1998). In fact, there is widespread agreement that, in turn, a positive mood influences employee behavior by supporting, among other things, creativity (Jovanovic, Meinel, Schrödel, & Voigt, 2016; Staw, Sutton, & Pelled, 1994). Furthermore, previous studies have showed that more open workspaces support communication and interaction (e.g. Boutellier et al., 2008). Therefore, our finding that such office types positively influence creativity bridges the gap to previous findings showing that both communication and interaction between employees enhance creativity (e.g. Kratzer, Leenders, & Van Engelen, 2004; Toker & Gray, 2008).

6. Conclusion

6.1. Theoretical implications

The main goal of this paper was to reveal how PWEs need to be designed to support creativity in organizations. In order to do this, we conducted a systematic review of the existing literature. Empirical evidence obtained from previous studies shows that the physical workspace can be designed in a way that fosters employees' creativity. The reviewed articles in this study offer a variety of perspectives on this research field. To the best of our knowledge, this is the first study to give a comprehensive examination of the various effects of the PWE on creativity. By systematically structuring and summarizing the diversity of empirical findings in this field, this article organizes PWE design possibilities into different categories, thereby adding new insight to the literature. Yet, although the number of studies in this field is growing, we are still at the beginning of understanding how workspace designs influence creativity. Against this background, our findings provide a foundation for further research in this field.

In a broader sense, this review expands not only the field of creativity, but also innovation management. Researchers as well as practitioners continuously try to understand how organizations can increase their innovation performance through enhancing organizational creativity. In this regard, designing creative workspaces represents an increasingly observable phenomenon in business practice to build such innovative organizations. In other words, although increased creativity can be seen as a desirable effort for itself, to maintain competitiveness, organizations need to channel their creativity into successful innovations. Therefore, one should consider not only the PWE's effect on creativity, but also its impact on organizational success through increased innovativeness. In this study, we shed light on the relationships among an organization's PWE, creativity, and innovation performance, and therefore contribute to the innovation management literature as well.

Finally, this study also contributes to the fields of architecture and, specifically, interior design. In particular, the findings of this literature review expand the understanding of how certain aspects of interior design influence individual and team behavior within organizations.

6.2. Practical implications

Companies increasingly face the challenge of how to design innovative workspaces that attract talented employees and enhance employees' creativity. The workspace designs of Google, Apple, and Facebook represent the first typical examples of companies that have received considerable media attention for their new workspace strategies. Although many other organizations are already investing in the design of such workspaces, there is no tried and tested formula for how workspaces need to be designed to optimally support employees' creativity. Still, organizations are left alone with questions such as the following: Which office elements should we consider for creative office designs? Do slides and ball pools work? Which office elements hinder creativity? Can we afford the design of creative workspaces? What can we do to get quick improvements? Based on our systematic review of the empirical literature, we offer answers to these questions on creative workspace design.

Some workspace characteristics are consistently found to be creativity-enhancing. These are the presence of plants, appealing sounds and smells, a window view, flexible furniture, adequate office size, an open office layout combined with individual spaces, and space for relaxation. Additionally, we found that these elements of the work environment support creativity regardless of the type of organization (e.g. university, start-up, established company). To boost creativity, we recommend that any organization should provide its employees a workspace including these PWE characteristics. For example, organizations should design their workspace in a way that supports different creative work modes. This means that workspaces should provide open spaces for teamwork and communication as well as individual spaces for concentrated work. This balancing act can be managed by providing elements that allow for situation-specific room use, including sliding walls or flexible furniture such as chairs, tables, and whiteboards that are lightweight and/or on wheels. Individual workspaces should be large enough to ensure employees' privacy. Additionally, organizations should provide spaces for relaxation, disengaged spaces, and doodle spaces. At first sight, these spaces might seem to distract employees from their actual work. Yet, they provide time for incubating on issues in which employees are stuck. In addition, these spaces systematically foster interaction among employees (across team borders), leading to situations in which valuable information and experiences are exchanged.

There are also PWE elements that consistently inhibit creativity. These include too high levels of noise, too high temperatures, an insufficient office size, the use of synthetic materials, and inflexible work arrangements. To achieve high levels of creativity, organizations should avoid the presence of these elements in their workspace. For example, the PWE should enable employees to meet with colleagues but also ensure individual privacy whenever needed. Finally, organizations should be careful with using processed or synthetic materials, such as plastic, carpet, or steel. In contrast, natural materials (e.g. wooden floor) are found to have a positive influence on creativity.

7. Limitations and further research

The current review has some limitations that offer possibilities for further research. First, the database of this study is limited to 17 articles, because this research field is still in its infancy and lacking in empirical evidence. Therefore, we motivate scholars to conduct further empirical studies on the PWE's effects on creativity. In particular, we suggest a twofold way to gain deeper insights into how to design creativity-enhancing PWEs. At first, it seems necessary to build a more comprehensive body of empirical literature through interviews and surveys with both creative experts and employees. To objectify these results, experiments should be conducted to investigate the influence of specific PWE elements on creativity. To do this, appropriate measurement constructs need to be developed to better assess the isolated impact of distinct PWE characteristics on creativity and to ensure comparability across results. Additionally, further research should strive for a more coherent research agenda. In this regard, scholars should particularly carry out conceptual studies by using and refining established theories in the field of creativity.

Second, we focused on empirical studies explicitly examining creativity or innovation as a dependent variable. Therefore, the paper omits empirical evidence from other fields (e.g. psychological studies on cognitive thinking) that may be linked to creativity. Even though this restriction was useful to give a first overview of empirical literature in the field, relevant studies in other fields were possibly excluded from the sample. Thus, to provide a broader picture, further research should identify connections between the PWE's influence on creativity and its influence on other factors (e.g. concentration or well-being) that, in turn, might promote creativity in the workplace.

Third, we presented the effects of distinct characteristics of the PWE on creativity, because most existing studies focus on single characteristics of the PWE and their individual influence on creativity. However, these single characteristics may also interact with each other, thereby influencing creativity in a more complex way. Further empirical studies could therefore examine interaction effects between different elements of the PWE. For example, it seems interesting whether the combination of elements that share the same style has a greater impact on creativity than elements of different styles. In this context, it also seems useful to investigate the role of boundary conditions on the effectiveness of workspace design for creativity, such as firm culture, firm location, or firm size. For some characteristics that are quite popular in practice (e.g. fun spaces), no significant direct effects on creativity could be determined so far. Therefore, it might be interesting to find out whether mediating effects exist between PWE characteristics and creativity through, for example, job satisfaction or employer attractiveness.

Fourth, the present categorization of creativity-enhancing characteristics of the PWE might be incomplete, since we inductively derived a categorization from the investigated PWE specifications in previous studies. Thus, the subcategories within the three main categories — *office elements* (e.g. plants, light), *spatial layout* (e.g. office layout, office size), and *space types* (e.g. relaxation space, doodle space) — should be understood as an initial collection that needs to be developed further towards an encompassing framework of PWE design possibilities. Accordingly, we encourage future research to look at creative workspaces from a conceptual perspective.

The result could be a framework that can be easily used in practice when firms want to rethink their current workspaces, aiming to foster employees' creativity and well-being.

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