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How task constraints affect inspiration search strategies

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Abstract
Searching for sources of inspiration is central to creative design; however, we have limited knowledge of individual inspiration search strategies in response to varying levels of task constraints. We studied 39 high-school students' inspiration search strategies using Google Images. Low task constrainedness led to *divergent search* marked by quick iterations, limited design task usage, and a heterogeneous image set. Intermediate constrainedness prompted *in-depth, on-task exploration* characterized by slow and careful iterations with more search result examination, extensive design task usage, and homogenous images. High constrainedness led to *flexible bracketing* with quick, flexible design task use, ending with heterogeneous images. Images from the intermediately and highly constrained conditions generated more ideas and were perceived as more inspiring (relative to low) in a new group of students. We discuss the idea of a '*sweet spot*' of constrainedness in an inspiration search process in design and consider implications for design research and future work.

Keywords Sources of inspiration · Search strategy · Constraints · Google Images · Quantitative study · Sweet spot

Introduction

American film director Jim Jarmusch (2013) once explained how he abides by a set of rules to guide his creative process, including the search for sources of inspiration. His fifth rule is "Nothing is original. Steal from anywhere that resonates with inspiration or fuels your imagination. Devour old films, new films, music, books, paintings, photographs, poems, dreams, random conversations, architecture, bridges, street signs, trees, clouds, bodies of water, light and shadows. Select only things to steal from that speak directly to your soul" (para 8). Such reliance on sources of inspiration is key in movie-making and the arts but is no less important in design education. Generally, design research has examined various types of sources of inspiration that might trigger creativity, e.g., artifacts and phenomena

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as in the above quote, or how sources of inspiration can be operationalized as resources in a creative design process. Exactly *how* designers and other creative persons search for inspiration—their *inspiration search strategies*—on the other hand, has received surprisingly little attention in the design and design education research communities.

Using digital technology such as web browsers to search for sources of inspiration among the abundance of files on the Internet has never been easier. This makes it relevant to understand how inspiration search strategies are carried out; not just among seasoned professional designers, but also among novice designers and design students undertaking creative tasks that rely on finding sources of inspiration. Professional designers will often use various tools for particular purposes. This could be non-specialist applications such as Instagram, Flickr, YouTube, or Pinterest, or more professionally oriented tools such as Behance or Dribble for showcasing one's own creative work and perusing other designers' projects to find inspiration (Koch et al. 2018). For design students, such specialist tools will rarely be the first choice. Therefore, this paper specifically studies the use of Google Images as a familiar, mundane search tool that novices and students are accustomed to use for both personal and school-related tasks. Moreover, searching for images on the Web has been identified as one of 19 ideation techniques most frequently utilized in design practice (Herring et al. 2009). The search strategy involved in searching for inspiration is fundamentally different from searching for information or facts. Quiz-like search tasks such as finding out who directed a particular movie are usually decisively determinable. In open-ended inspiration search strategies, the person engaged in the search activity will often not know what s/he is looking for, but hope to discover something, which as a source of inspiration might 'fuel his/her imagination,' to paraphrase Jarmusch.

To supplement previous work on the specific ways in which sources of inspiration are utilized in a creative process, this paper takes one step back to examine concrete inspiration search strategies meant to bring about a generative result. Specifically, the paper explores how dissimilar levels of *task constraints* affect actual inspiration search strategies. While constraints are not inexpedient in creative processes in general, having too many options to choose from might often be detrimental to creativity (Joyce 2009; Schwartz 2005). It would, therefore, seem plausible that the *constrainedness* (Onarheim 2012b) of a given creative task, i.e., how broadly/vaguely or narrowly/precisely the task is defined, will affect the actual inspiration search strategy. This makes it relevant to study how varying levels of constrainedness in the formulation of a creative task will affect a person's inspiration search strategy when s/he has access to a huge number of sources of inspiration. So far, this specific, local effect on inspiration search in a design process has not been fully investigated.

We present an empirical study of how high-school students use Google Images to search for inspiring images in response to three creative design tasks. The three tasks represent varying levels of constrainedness as expressed by their specific wording, from a clearly open-ended creative task (*low* constrainedness) over a more standardized creative task featuring some keywords (*intermediate* constrainedness) to a very detailed creative task (*high* constrainedness) with several keywords that as search terms can be typed into the web browser immediately to initiate the image search process.

Our *main contribution* is based on this empirical study and offers insight into how varying levels of constrainedness in creative tasks affect inspiration search strategies. We discern three such strategies, which we refer to as (a) *divergent searches*, (b) *in-depth, on-task exploration*, and (c) *flexible bracketing*, pertaining to a low, intermediate, and high level of constrainedness, respectively. Inspiration search processes are initiated in response to the information stated in a creative task. Our study finds that neither too little, nor too much available information conceived as constraints will be conducive to creativity. The inspiration search strategy will thus often entail that the person engaged in the search activity will either add or temporarily remove (bracket) information in order to establish a *'sweet spot'* of constrainedness with neither too many, nor too few constraints expressed as the terms represented in the formulation of the creative task. This insight is relevant to *design researchers* interested in inspiration search strategies as an important design activity, and to *design practitioners* and *design educators*, who solve or devise creative design tasks where finding sources of inspiration is critical.

The paper is structured as follows. First, we provide an overview of research on sources of inspiration, constraints, and search strategies of which most studies have focused on the relevance of information obtained through search queries. We then present our empirical study of 39 high-school students' inspiration search strategies using Google Images. We analyze our data using mainly quantitative and, to a lesser extent, qualitative measures and discuss our findings, including the idea of a 'sweet spot' of constrainedness in an inspiration search strategy. Finally, we consider our study's limitations and our findings' implications for design research and future work.

Sources of inspiration in design

When referring to inspiration in a creative design process, it is important to distinguish between *inspiration* and *sources of inspiration*. Etymologically, the former can be traced back to thirteenth-century French and is often conceived figuratively as "A breathing in or infusion of some idea, purpose, etc. into the mind; the suggestion, awakening, or creation of some feeling or impulse, especially of an exalted kind" (Simpson and Weiner 1989, p. 1036). More recently, Thrash and Elliot (2003) gave a less abstract, domain-general conceptualization of 'inspiration,' arguing that it has three characteristics. It includes *motivation* as directed behavior, it is *evoked* rather than arising through will alone or 'out of the blue,' and it involves *transcendence* in exceeding ordinary human actions and cognitive processes. Conversely, sources of inspiration are concrete elements of information deliberately brought into a creative design process as stimulus objects or *triggers* to evoke inspiration for a specific purpose or *target* such as a creative product or a personal aim (op. cit.). This means that inspiration should not be seen as a *source* of creative ideas but as a motivational *response* to creative ideas in the sense that "inspiration explains the transmission, not the origin, of creativity (Oleynick et al. 2014, p. 2). The focus of the present paper is neither inspiration as an abstract 'exalted feeling or impulse,' nor its well-established domain-general relevance, e.g., as a potentially universal effect on creativity arising from the aesthetic experience of art (An and Youn 2018). Rather, it is the *search strategies* involved in finding sources of inspiration, here images obtained online.

Sources of inspiration are considered integral to design (Sanders 2005) and necessary for continuing creativity (Eckert and Stacey 2002). Using sources of inspiration instrumentally in design is a familiar topic (e.g., Bonnardel and Marmèche 2004; Gonçalves 2016), and its relevance to the emergence of design concepts is well-known (Halskov 2010; Halskov and Dalsgaard 2007). How, and to what extent, introducing sources of inspiration might influence creativity depends on the level of expertise of a designer or any other creative person involved in a design process (Bonnardel and Marmèche 2004). Several studies on the role of sources of inspiration in design have examined textile design, particularly knitwear. Eckert and Stacey (2000) showed how a design process can be initiated through the use of previous design artifacts, objects, and images. Petre et al. (2006)

identified overarching categories of inspiration in this domain, e.g., other garments, works of arts, and natural phenomena. Their categorization echoes Mete's (2006) investigation of the fashion industry, showing how sources of inspiration might improve originality of the final design, but might also be utilized in a deliberately regulatory or constraining way so as to ensure harmonious color schemes and uniformity in a fashion collection. In another design domain, Kelley and Littman (2001) documented how designers at IDEO would collect gadgets and materials as sources of inspiration and store them in file cabinets so that the artifacts could be used in future design projects. In the context of industrial design education, Santulli and Langella (2011) reported how examples from nature might inspire the design of sports items with regard to requirements such as safety, comfort, and multi-functionality. Undertaking a broader scope, Luo and Dong (2017) argued that learning to engage with sources of inspiration is particularly critical in design education. They explored the role of two kinds of cultural inspiration—textual inspiration and pictorial inspiration. Interestingly, they found students working with textual inspiration to be more creative than those using pictorial inspiration. Finally, and since inspiration often occurs in Sudden Moments of Inspiration (SMI), Wu and Wang (2015) discovered a clear effect of subconsciousness on SMI in the sketching process of industrial design.

Sources of inspiration in design and design education, therefore, have a dual role. While they can facilitate idea generation, e.g., via analogical thinking (Christensen and Ball 2016) such as in said biologically inspired design (see also Helms et al. 2009), and potentially lead to original ideas, they can also be detrimental to creativity. One example is Marsh et al.'s (1999) study, showing how participants, who were tasked with creating English nonwords after having seen examples of nonwords embedded with regular orthographic structures, would come up with nonwords conforming to the examples—even though they were instructed to *avoid* using features from the examples. In this way, sources of inspiration might lead to design fixation (Crilly and Cardoso 2017; Jansson and Smith 1991), which design novices and experts will often approach in dissimilar ways (Moxley et al. 2012; Sio et al. 2015). It is important to remember, however, that while cognitive fixation may lead to inefficient search strategies during information retrieval (Mumford et al. 2006), this might not necessarily be a bad thing in design (Cross 2006, p. 104). To better understand how sources of inspiration take on this dual role in a creative task by both enabling and constraining creativity, it is relevant to look toward research on the role of constraints in design.

Constraints in creative design tasks

Etymologically, to 'constrain' might suggest an exclusively restraining property in the sense that constraints are seen as "limitations on action [that] set boundaries on solutions" (Vandenbosch and Gallagher 2004, p. 198). In design, this understanding is not adequate. As Boden (2004) observed, "constraints on thinking do not merely constrain, but also make certain thoughts—certain mental structures—possible" (p. 58). This dual role of constraints has been underlined by several researchers (e.g., Elster 2000; Joyce 2009; McDonnell 2011; Onarheim and Wiltschnig 2010) and marks a break with previous research, which often saw design as the ability to meet specific sets of requirements. This prior understanding can be traced back to seminal work on rational problem-solving in Human–Computer Interaction (HCI) and computer science. Reitman (1964) described how "each problem defines a set of constraints that must be met by subsequent transforms if they are to lead to a solution of that problem" (p. 305). Later, and informed by Reitman's work, Simon (1996) contributed the oft-cited definition of design according to which "everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (p. 111) so that "design [...] is concerned with how things ought to be" (p. 114). This view on design is also based on constraints insofar as "design solutions are sequences of action that lead to possible worlds satisfying specified constraints" (p. 124).

As noted by Dorst (1997), Schön (1983, 1992) gave an alternative to this rational problem-solving approach to creative design tasks by underlining the reflective practice of design and that each creative design problem be seen as unique—"a 'problem space' is not given by the presentation of the design task" (1992, p. 11), nor simply by the constraints it encompasses. Schön stressed the active role of the designer in the sense that "the designer *constructs* the design world within which he/she sets the dimensions of his/her problem space, and invents the moves by which he/she attempts to find solutions" (ibid., orig. emphasis). According to Schön, a designer does not suddenly 'jump' from problem to solution. Working with constraints in a creative task means working toward a creative event (e.g., an insight moment) when a unique problem–solution pairing is framed. Schön (1983) called this 'problem framing.' This idea of problem–solution co-evolution, in which working with constraints in a creative design task is critical, has been picked up by other researchers (e.g., Maher and Tang 2003; Wiltschnig et al. 2013).

Understanding how sources of inspiration take on the dual enabling-restraining role of constraints in a creative design task thus requires a more nuanced conceptualization of a *design space* (Dove et al. 2016) than "a space of possibilities" (MacLean et al. 1991, p. 203) or something that "constrains design possibilities along some dimensions, while leaving others open for creative exploration" (Beaudouin-Lafon and Mackay 2003, p. 9). As Reitman, Simon, and others stressed, having a clear understanding of the importance of constraints is critical to understanding design as a problem-solving activity, but just as important is Schön's insight that a designer, when engaged in a creative activity, works with constraints in a manner that goes beyond purely rational constraint satisfaction. We thus subscribe to the idea of seeing a design space as a conceptual space comprised of "the *creativity constraints* that govern what the outcome of the design process might (and might not) be" so that a design space is "co-constituted, explored, and shaped by the designer throughout the design process" (Biskjaer et al. 2014, p. 461, orig. emphasis). This means that a designer can, to some extent, shape, his/her design space by selecting or deselecting, various sources of inspiration that serve as creativity constraints that are not necessarily per se either completely free or fully fixed, but can be challenged, modified, or even ignored.

The total 'pressure' of the creativity constraints, which can be referred to as *constrainedness* (Biskjaer 2013; Onarheim 2012b), might vary significantly and is highly relevant in design, e.g., as time pressure in industrial design projects (Hsiao et al. 2017). Stacey and Eckert (2010) introduced graduating this constrainedness in a loosely defined continuum of overconstrained versus underconstrained creative problems. In their terminology, overconstrained problems are creative problems or tasks with many strong constraints that must be met unconditionally as exemplified by engineering; a view echoing said work by Reitman and Simon. Underconstrained creative problems, as illustrated by more art-oriented creative design practices such as the knitwear designers whom Stacey and Eckert studied, are marked by having many more weak constraints that can be relaxed. This idea of a continuum of underconstrained versus overconstrained creative problems and tasks builds on previous conceptualizations of creative problems, among them ill-defined (Eastman 1969; Reitman 1964; Schraw et al. 1995), ill-structured (Goel 1992; Simon 1973), and wicked problems (Buchanan 1992; Churchman 1967; Rittel and Webber 1973), albeit these do not focus primarily on levels of constrainedness. Stacey and Eckert's (2010) underconstrained versus overconstrained continuum has two extremes. In practice, few (if any) creative problems or tasks are located at either end. Rather, most creative problems and tasks can be challenged in accordance with Schön's (1983, 1992) idea of problem-framing and malleable design spaces. This makes it relevant to consider the *strategies* behind how such constraints are treated in a creative task, e.g., in the choice of working with and adopting either more or fewer sources of inspiration, which will thus take on the dual enabling-restraining role of constraints.

A 'sweet spot' of constrainedness in a creative task

Studies of expert engineering designers working with highly complex, overconstrained problems have revealed how these designers use various creative strategies to alleviate constrainedness (Onarheim 2012a). Such strategies include black boxing (treating certain constraints as unchangeable), removal, revision, and, occasionally, introducing additional constraints (p. 9). Similarly, research has shown how it might be beneficial to introduce (radically) new constraints into a creative activity (Biskjaer 2013) in order to establish "a way into the problem" (Darke 1979, p. 38). Introducing such new constraints might even become decisive for the final design (Biskjaer and Halskov 2014). Joyce (2009) summed up the role of constraints by saying that "while absolute constraint undermines creativity and intrinsic motivation, too little constraint is also counterproductive, resulting in decreased creativity and originality. Although some degree of choice has repeatedly been shown to be essential to creativity, the 'freedom' of the blank page can actually stifle creativity" (p. 8). Consequently, designers must find creative strategies of coping with design tasks marked by very many—or few—constraints.

In practice, a *too high* level of constrainedness (too little creative freedom) will make it hard for the person involved to initiate a resolution of a creative task, since it is cognitively more difficult to process all the given task constraints. This prompts the need to apply a creative strategy to manage this constrainedness. A *too low* level of constrainedness (too much creative freedom) might for some cause the 'paradox of choice' (Schwartz 2005) where it is difficult to establish a primary generator (Darke 1979) as a starting point. One way of framing this schism of neither too little, nor too much constrainedness is by the expression 'striking a balance' (Onarheim 2012b). A well-known, related example of such balancing is Csikszentmihalyi's (2008) concept 'flow,' which, in a simplified form, can be explained as the benefit of matching challenges and skills in order to reach a state of complete immersion in a creative activity. Csikszentmihalyi's flow model, however, does not target *perceived inspiration*, but perceived challenges and the skills needed to resolve them as the two co-evolve. An alternative to his diachronic model is a more snapshot-like, synchronic illustration of any given point in a creative process as seen from one person's perspective. If neither too much, nor too little constrainedness is favorable for creativity, this suggests the benefit of positioning oneself in a fertile middle ground. This theoretical proposition can be depicted as an inverted U-shape with a person's perceived potential for creativity (Y-axis) as a function of a creative task's level of constrainedness (X-axis), see Fig. 1. This desirable middle position can be referred to as a person's '*sweet spot*' (Biskjaer 2013; Onarheim 2012b) based on the level of constrainedness of a given creative task. The inverted U-shape illustrates how a person's perceived potential for creativity drops when moving toward a notably lower (underconstrained) or higher (overconstrained) level of

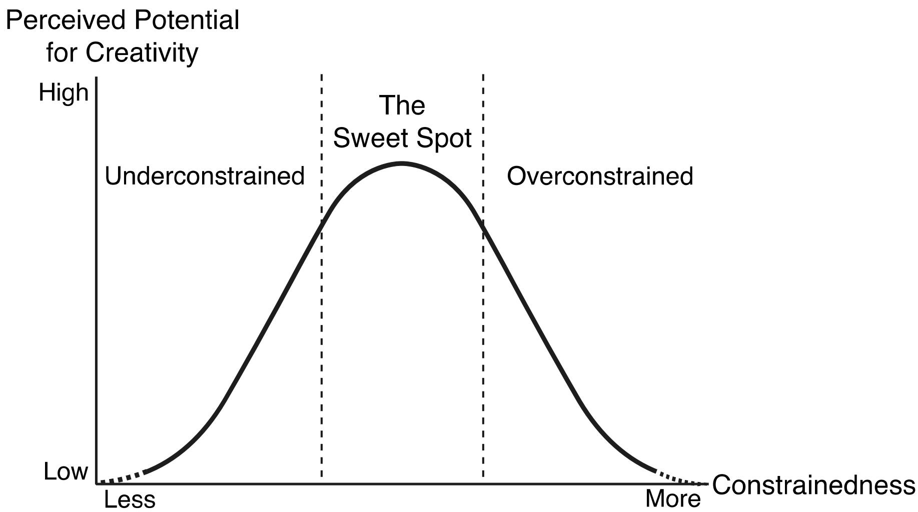

Fig. 1 The 'sweet spot' model of striking a desirable balance between a creative task's constrainedness and a person's perceived potential for creativity (see Biskjaer 2013; Onarheim 2012b)

constrainedness, showing that neither a too low, nor a too high level of creative task constrainedness is desirable.

Building on this theoretical proposition, we argue that the idea of a 'sweet spot' based on a desirable level of creative task constrainedness is equally valid in terms of sources of inspiration in the sense that the Y-axis might denote a person's level of *perceived inspiration*. This connection between varying levels of constrainedness and its effect on perceived inspiration has, to some extent, been foregrounded by Elster (2000) who saw inspiration as "the rate at which ideas move from the unconscious into the conscious mind" (p. 212), so that inspiration becomes "an inversely U-shaped function of the tightness of the constraints" (ibid.). Elster, however, never explored this connection between creative task constrainedness and inspiration in any great depth. As a designer engaged in an inspiration process, having too many sources of inspiration will often be detrimental to creativity, since sources of inspiration, as information, function as constraints. The same goes for having too few sources of inspiration. If one has *too many* sources of inspiration available, it becomes necessary to *bracket* or *ignore* some, i.e., move toward one's individual 'sweet spot' from the *right-hand, overconstrained* side of the inverted U-shape. If one has *too few* sources of inspiration in a creative design task, it becomes imperative to *add* new, relevant sources of inspiration, i.e., move toward one's 'sweet spot' from the *left-hand*, *underconstrained* side of the inverted U-shape. Adding sources of inspiration, therefore, gives rise to the critical question of how to find them.

Inspiration search strategies in design

Although sources of inspiration is a familiar topic in design research, e.g., in studies of the creation of mood boards (Lucero 2012) and the use of digital pin boards for everyday ideation (Linder et al. 2014), surprisingly few studies have examined in detail the concrete *inspiration search strategies*. Most studies have focused on *general* search strategies for retrieving information conceived as fact-finding in order to determine questions such as who directed a particular movie. Several studies have examined strategies of information search and processing in decision making (Payne 1976), e.g., how time pressure affects such activities (Verplanken 1993). A number of studies have examined search strategies in specific domains, e.g., how so-called ‘search tactics’ can improve bibliographic and reference searches (Bates 1979); how tourists’ information search strategies involve different media and information resources (Fodness and Murray 1998); and how age affects online search strategies and the retrieval of correct answers to a task (Stronge et al. 2006). Other studies have explored where best to draw the line between configurability of a search system and relevant user control (Bates 1990); why novice searchers struggle to develop an effective information search strategy (Debowski 2001); and strategies for vetting, managing, and interpreting content online when searching for other people—or even oneself (Kuzminykh and Lank 2016).

Most studies of search strategies interpret searching as an activity for obtaining information such as an answer to a well-defined problem, often related to decision-making. Recently, however, an important contribution was made by Harms et al. (2018) who separated and measured information search as an intermediary process in creative problem solving. By studying 221 undergraduates at an American Midwestern university as they worked on a problem pertaining to juggling personal, social, and academic demands, the authors found that the “length of time spent searching, the quantity of information viewed, and the breadth of information search mediate the relationship between problem construction engagement and creativity across categories” (p. 1). This led to the conclusion that when engaged in problem construction (Reiter-Palmon et al. 1997), “the more efficiently they [the participants] searched for information, the more creative their solution” (ibid.), suggesting that “broader information search is necessary to generate solutions to ill-defined problems” (p. 10). This lends empirical evidence to the general agreement that the quality of information search affects creative performance (Illies and Reiter-Palmon 2004).

Interestingly, Harms et al. (2018) never discuss *inspiration*, which points to the fact that few studies have focused specifically on strategies for finding sources of inspiration as a distinct activity that should not be subsumed under creative problem solving proper. So far, some studies included the design of new digital search tools, e.g., based on social media chatter (Paraskevopoulos et al. 2014) or as a semantic-based image retrieval algorithm (Setchi and Bouchard 2010), to explore inspiration search. Others examined design students undertaking a self-set, naturalistic information search task, noting how they would prefer images as inspiration content and manifest diverse use behavior when working with sources of inspiration (Makri and Warwick 2010). Another study explored teens’ information experiences with social media and Google Images for finding and working with sources of inspiration conceived as ‘information literacy’ (Harlan et al. 2012).

In design education research, few studies have examined information search strategies. One notable exception is Quintana et al. (2012) who compared students with general school training in ICT (Information and Communication Technology) and students without, focusing on Web literacy in general. Students with ICT training showed better command of digital technology but still lacked key skills in terms of Web literacy. Chen (2016) carried out a quantitative study of industrial design students’ use of resources in the design studio. The category ‘objects,’ which included objects found on the Internet, comprised 30% of the resources used by the students. In a comparative study, Gonçalves et al. (2014) studied students’ and experts’ preferred inspirational approaches and observed that both groups often ignore additional, proven efficient, design creativity methods for ideation. Chan et al. (2015) showed that citing sources of inspiration tends to be associated with more original ideas although conceptually closer, as opposed to farther sources, seem to be more conducive to the emergence of creative ideas. Mougenot et al. (2008) studied expert car designers' information gathering strategies when searching for inspiration. When comparing the designers' use of online media and printed magazines, the study found visual materials, primarily images, to be predominant although the expert industrial designers preferred printed magazines to searching online when looking for inspiring images. It seems likely that this preference might have changed over the past decade. Indeed, Koch et al. (2018) showed that "the Internet has become a prevalent source for ideas in design" (p. 1), and "most designers nowadays find potentially inspiring visual material and solutions online" (p. 10).

This prevalence of *images* when searching for inspiration would suggest the presence of one or more specific search strategies for finding the most potent sources of inspiration for a creative task. Still, even seasoned image professionals rarely adopt a clear strategy. By analyzing two samples of search logs from a big commercial image provider over a 1-month period, Jörgensen and Jörgensen (2005) found that even though descriptive and thematic search queries were more common, the search tactics overall "do not appear to be carefully thought out and seem to be largely experimental" (p. 1346). This led the authors to conclude that although these professionals were experts in searching for inspiring images, they seemed to have an "inability to do so in an effective way" (ibid.). The same lack of application of deliberate inspiration search strategies is evident in design.

Informed by these insights and the limited literature on how inspiration search strategies are carried out in response to varying levels of task constrainedness, we conducted the following study.

Method

Participants

Thirty-nine Danish high-school students (age 16–18; 14 female) participated in an experiment on inspiration search strategies (part I) as part of a weeklong interdisciplinary project in two mandatory courses—Business Economics and Social Studies. The project was part of a design case competition challenging the students to design the best (fictional) business from scratch; a task that, given its open-endedness, made the students' initial inspiration searches thus more relevant. We collected data during the first day of the project week where the students were in the preliminary ideation phase. Subsequently (part II), 42 Danish high-school students (the same students as in part I plus three new students) used the obtained sources of inspiration in creative selection and idea generation tasks.

Procedure and coding

Participants were randomly divided into three conditions of design task constrainedness: Low (n = 14), Intermediate (abbreviated Med.) (n = 11), and High (n = 14). They were instructed to imagine that they had to come up with an idea for the design of a new business and needed sources of inspiration. This was followed by a condition-specific task description (see Table 1 for the formulations of the design task) containing approx. 1, 7, and 13 task words suitable as search terms in an online image search.

Table 1 Manipulations of constrainedness in the design task (transl. from Danish)

Low	*Task:* Find sources of inspiration for a new business
Med.	*Task:* Find sources of inspiration for an innovative, sustainable, new business that uses digital technology for products or services
High	*Task:* Find sources of inspiration for an innovative, sustainable, new business that uses digital technology for products or services for experiences at Kongens Nytorv [a large public square in downtown Copenhagen], e.g., within tourism, sports, art, or culture

Apart from the different design tasks, the procedure was identical across conditions. The subsequent procedure entailed tracing individual search behavior online, ending in the individual selection of inspiring images (part I) followed by tests of whether the individually selected inspiring images were inspirational to a new group of students, and led to more ideas generated (part II). For an overview, see Fig. 2.

Part I: Individual search

All participants received the design task in paper format. They were seated individually in front of their personal laptop and asked to perform Google Image searches and select five inspiring images that would aid their subsequent design process. The students searched for images individually for 15 min while their screen activity was recorded using *screen-capture software* (Open Broadcaster Software). The five images selected as inspiring by each participant were collected for use in the second part of the experiment.

Based on their extensive coding experience from an international design research project, one graduate student and two research assistants (with master's degrees) examined the screen captures and *coded* the onset time and individual search strings, the number and content of images selected for enlarged viewing under each search string, images selected under each search string and the positions of the images in the search result, the duration

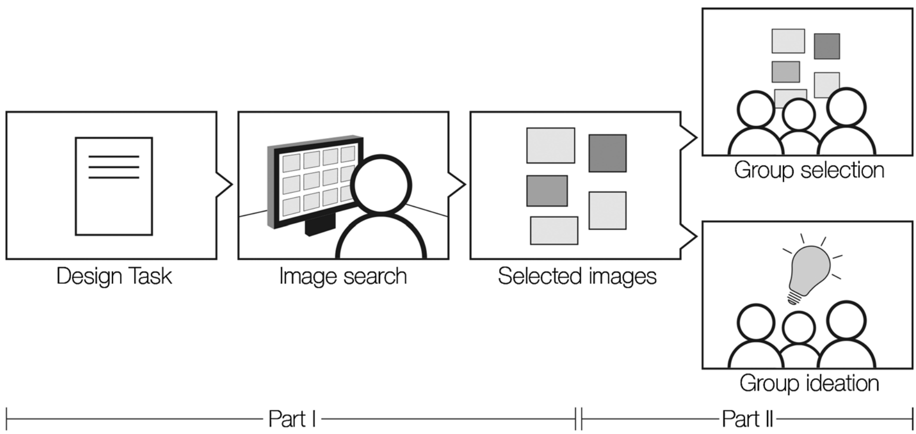

Fig. 2 Experimental procedure overview

of the search (defined as the difference from the search string onset time to the onset of the next search string). The ten most frequently used search terms per condition are shown in Table 2.

The search term content was then *categorized* by the coders as entailing one of *three types of searches*: (1) search strings *not* related to the stated design task (labeled 'None' in Figs. 3 and 4); (2) search strings *partly* selected from the design task ('Some'), and (3) search strings *entirely* selected from the design task ('Only'). Interrater reliability for the search type coding was excellent as checked by an independent coder on 8% of the data (Cohen's $\kappa = .844$). Due to the objective character of the other codes (e.g., onset time or search string entry), additional interrater reliability was not carried out.

We also conducted *semi-structured interviews* with one student from each of the design task groups, i.e., Low, Med., and High, asking questions related to search strategies behind each of the five images they had chosen as most inspiring. These three interviews were recorded and transcribed. Finally, two coders, blind to condition, examined whether the images stemming from each condition varied in level of *homogeneity*. In an image sorting exercise, the entire pool of images was sorted into a number of categories of varying sizes by image content similarity. The coders were asked to sort the images by content until no more meaningful clustering could be done. This resulted in categories ranging from one to ten images, with categories of one being images that did not match any other image content-wise (i.e., unique content in the set).

Part II: Group selection and ideation

To examine which condition led to more inspiring images, a subset of the images selected in Part I was evaluated and selected and subsequently used in ideation in group settings. The purpose was to collect behavioral consequences of the individual image selection on subsequent group performance. In order to avoid confounding group effects with individual ownership biases, the students worked with images they had not selected themselves for both the selection and ideation task.

Selection Fourteen groups of three students were given a complete set of five images (each group was randomly assigned complete image selections from different participants in part I) from each of the three conditions, yielding a total of 15 images per group. These

Table 2 The ten most frequent search terms per condition (transl. from Danish)

Low	Med.	High
Business[2]	Digital[2]	Nytorv[2]
Innovative[1]	Technology[2]	Copenhagen[2]
Success[1]	Business[2]	Innovative[2]
Conor McGregor[1]	Sustainable[2]	Sustainable[2]
Design[1]	Innovation[2]	Art[2]
Interior[1]	Recycling[1]	Kongens/King's[2]
Inspiration[2]	Product[2]	Tourism[2]
Giant[1]	Sources of inspiration[2]	Digital[2]
Smart[1]	Services[2]	Technology[2]
Fashion[1]	Energy[1]	Ideas[1]

Numbers indicate whether the term was present in the design task formulation: *1* absent, *2* present student groups were blind to which condition the images originated from. The groups were asked to select the five most inspiring ones from this pool of 15 images.

Ideation The same fourteen groups as in the selection task were asked to perform three group ideation sessions for 5 min using as inspiration new sets of five images (each group received complete image selections from different participants in part I) stemming from the three conditions. The three ideation sessions were counterbalanced across groups for the ordering of the levels of constrainedness. For each of the three ideation sessions, the group received a full set of five inspiration images. The subsequently generated ideas were then recorded for each group member.

Analysis

The analysis of the effects of the constrainedness condition was divided into four parts, relating to effects on individual search behavior (part Ia); the homogeneity of the resulting selection sets (part Ib); effects on images being selected as inspiring by a new group of students (part IIa); effects on the number of ideas generated by a new group (part IIb). Descriptive statistics relating to search string entry counts, search length, search duration, clicks per image, and the number of ideas generated are shown in Table 3.

Part Ia: Effects of constrainedness on individual search behavior

As expected, the length of the search strings (number of terms) varied with constrainedness condition $F(2, 722)=28.48$, $p=.001$, with follow-up Tukey HSD tests illustrating a linear increase of search string length with constrainedness where Low was significantly shorter than Med. ($p=.003$) and High ($p=.001$), with Med. also being significantly shorter than High ($p=.02$).

The three constraint groups differed in terms of the number of search strings each participant entered, ANOVA $F(2, 38)=4.54$, $p=.02$, with follow-up Tukey HSD tests revealing that the Med. constrainedness condition performed fewer image searches than the Low ($p=.02$) and High condition ($p=.04$), but with Low and High not being significantly different ($p=.96$). Correspondingly, the three conditions differed in terms of the duration of each individual search, ANOVA $F(2, 722)=5.81$, $p=.003$, with follow-up Tukey HSD tests revealing that the Med. constrainedness group performed *longer searches* than the Low ($p=.004$) and High condition ($p=.008$), but with Low and High not being significantly different ($p=.95$).

Table 3 Descriptive statistics by constrainedness condition

	Low		Med.		High	
	M	SD	*M*	SD	*M*	SD
Search string length (terms) per search	1.9	1.1	2.4	1.3	2.7	1.2
Search string entries per participant	21.6	10.3	12.1	5.6	20.7	8.5
Search duration (sec.) per search	38	49	54	51	39	42
Clicks per search	1.4	0.9	2.3	1.9	0.8	0.5
Ideas generated per group participant	2.9	1.5	3.3	2.0	3.3	1.9

The level of constrainedness significantly affected the *type of search* conducted, $\chi^2(4, 725) = 169.01$, $p = .001$. As shown in Fig. 3, there are several key differences. Follow-up 2 × 2 Chi Squares revealed that the Med. constrainedness group stood out as entering *significantly more search strings* with terms *only* stemming from the design task than the Low $\chi^2(1) = 102.05$, $p = .001$ and High condition $\chi^2(1) = 35.13$, $p = .001$, even though the High condition had many more design task words to choose from when searching in Google Images. The High group significantly exceeded the Low group $\chi^2(1) = 23.14$, $p = .001$. Conversely, the Med. constrainedness group also entered *fewer search strings without any words* stemming from the design task (labeled 'None') than both the Low $\chi^2(1) = 139.38$, $p = .001$ and High condition $\chi^2(1) = 28.59$, $p = .001$. The Low group significantly exceeded the High group $\chi^2(1) = 66.30$, $p = .001$. The Med. group, therefore, behaved very differently from the other two groups in the type of searches conducted.

Comparing across conditions for search string types, there is a notable development over time, see Fig. 4. The proportion of searches containing None of the search terms from the design task that were executed in the first half (relative to the second half) of the search varied by condition, $\chi^2(2) = 12.74$, $p = .002$. Follow-up 2 × 2 Chi Squares showed that the Low group made more of these None searches early on compared to Med. $\chi^2(1) = 8.94$, $p = .003$ and High $\chi^2(1) = 6.09$, $p = .02$, while Med. and High did not differ $\chi^2(1) = 2.87$, $p = .09$. For the Some category, no differences across time could be identified $\chi^2(2) = 2.97$, $p = .23$. Due to expected counts less than five, the 2 × 3 Chi Square could not be performed for the Only category, but follow-up 2 × 2 comparisons revealed that the Low and Med. categories did not differ (2-sided Fisher's exact test, $p = .11$), but that both Low $\chi^2(1) = 9.91$, $p = .002$ and Med. $\chi^2(1) = 6.80$, $p = .01$ exceeded the High category. Taken together, these results indicate that the Low condition seemed to use mainly searches without any words from the

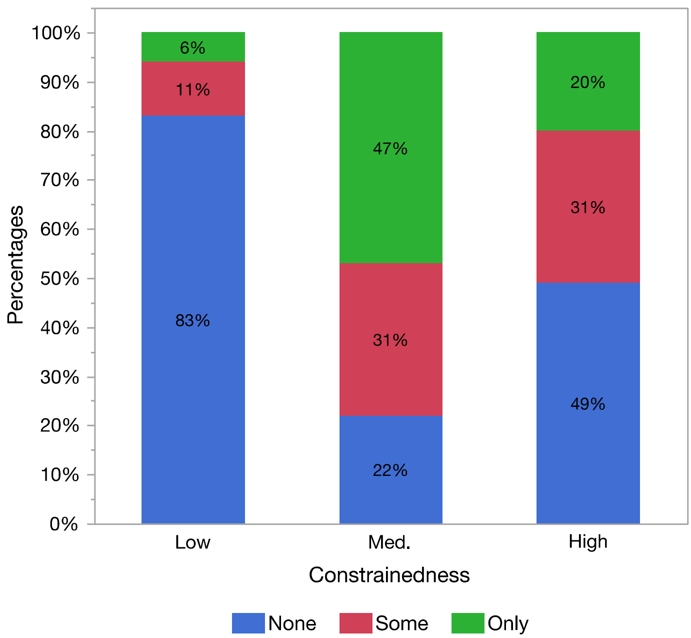

Fig. 3 Search type (whether the search string used None of, Some, or Only words from the design task formulation) in percentages by condition

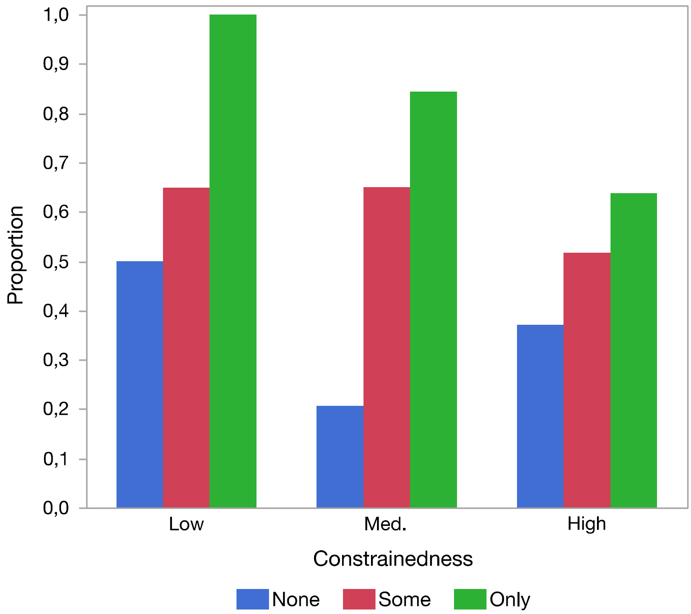

Fig. 4 Proportion of search string query types conducted in the first half of the search process (relative to the second half) by constrainedness condition

design task, but insofar as Only searches were used, they were used early in the process. The Med. condition deployed fewer searches, many of which were Only searches early on, but then None at a later stage. For the High condition, a more even distribution over time for all search type categories was evident.

The constrainedness conditions also differed in terms of the number of different image clicks each search generated ('clicks per search'), ANOVA $F(2, 722) = 13.56$, $p = .001$. Follow-up Tukey HSD tests showed that the Med. group had significantly more clicks than both the Low ($p = .002$) and High category ($p = .001$), while Low and High did not differ significantly ($p = .11$). This indicates a *continued and elevated effort in searching through the search results* in order to find more hits in the Med. constrainedness condition. There was, however, no significant difference in how deep into the image search results the students would look, i.e., how many lines they scrolled down among the search results before clicking, $F(2, 596) = 2.05$, $p = .13$.

Qualitative observations

Students in the *Low constrainedness condition* used search strings where the most frequent words in the searches were 'business,' 'innovative,' and 'inspiration', while the majority of search strings could not be traced back to the design task. In the follow-up interview, one participant said: "*I applied a principle, where I thought, 'okay, how do you create a new business? … You need new ideas!'*." This guiding principle led him to type in "how to be innovative" and "new ideas," resulting in selecting two "how to" images depicting a process ("Ten ways to make anything more innovative") rather than an abstract or iconic image, see Fig. 5, top left. Compared to the Med. and High conditions, the Low condition

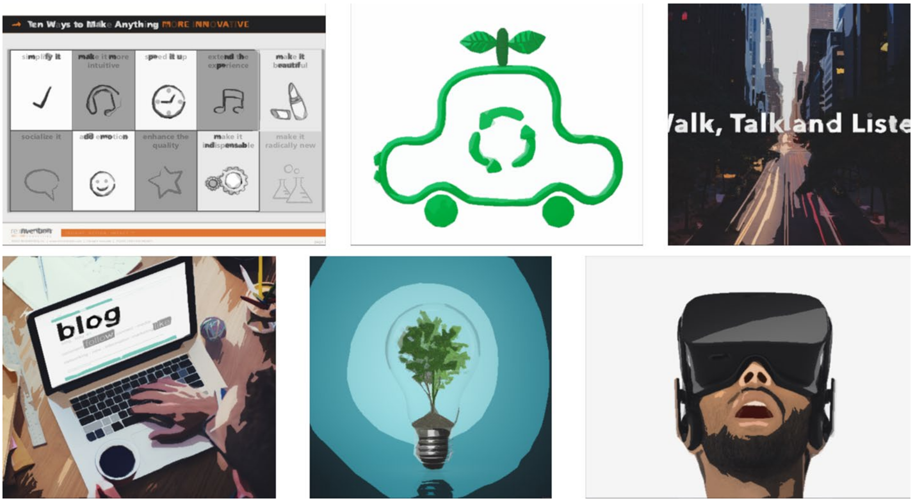

Fig. 5 Sample images* selected from the Low (left), Med. (center), and High (right) constrainedness conditions. (*Images from Google Image searches have been manipulated for publication)

seemed to include more images for guiding the inspiration process as opposed to containing inspiring content in and of itself.

Students in the *Med. condition* used search strings where the most frequent terms were 'digital,' 'technology,' 'business,' and 'sustainability.' A student in this condition exclaimed frustration concerning the outcome of the search 'sustainability': "*It [the search] was like superficial green, so it was not there it [the idea] came… You had to scroll down.*" She clicked on several images but did not choose an inspirational image until 10 min and seven search strings later, resulting in selecting an iconic picture of a sustainable car, see Fig. 5, top center. The Med. constrainedness condition seemed to yield more such sustained and effortful engagement with the search results.

A student from the *High constrainedness condition* did not use search strings directly from the design task in his first search: "I started thinking of what was realistic when it was to be located in the city, and then I came up with this 'walk and talk,' because it is something you've heard before. And then I worked on improving that." He typed in 'walk talk and listen' as his first search. This prompted an image with inspiring text, which he chose as one of the five inspiring images, see Fig. 5, top right. In the High condition, the students more often applied search strings pertaining to *location* (Kongens Nytorv is a large public square in downtown Copenhagen), either the location itself or some recognizable activity related to the location as a starting point for their search. The most frequent words in the High condition searches were 'Copenhagen' and 'Nytorv' alongside 'innovative.'

Part Ib: Effects of constrainedness on the homogeneity of the set of inspiring images

After all the students had selected five images as sources of inspiration, we studied whether the images stemming from each condition varied in level of *homogeneity*. The entire pool of images was sorted blind to the condition by two coders into a number of categories by content similarity. This led to categories containing one to ten images.

To account for the Poisson distribution of the dependent variable (count data), a GzLM Poisson regression was run to predict category size based on constrainedness condition. With Low as referent, the Med. category significantly predicted category size $\chi^2(1)=7.89$, $p=.005$, but the High category did not reach significance, $\chi^2(1)=.22$, $p=.64$. Switching the referent category to High similarly showed that the Med. category significantly predicted category size, $\chi^2(1)=5.28$, $p=.03$. This result shows that the images selected in the Med. constrainedness condition were *significantly more homogenous* (i.e., images were sorted in relatively larger categories) than the other two groups, see Fig. 6. The effect was, however, driven by the largest group of images (a category of ten images very alike, mainly from the Med. constrainedness condition).

Part IIa: Effects of constrainedness on images being selected as inspiring by a new group of participants

After the image selection, new groups of students, who had not seen the images, were given a Low-Med.-High image set (15 images in total) and asked to select for a final set the five images they found most inspiring. The groups selected blind to condition. A logistic regression analysis was run to test if the constrainedness level of the individual image predicted subsequent image selection. The model was overall significant $\chi^2(2)=10.91$, $p=.004$, Nagelkerke $R^2=.07$. With the referent category Low, the Med. ($p=.002$, odds ratio $=3.35$) and High ($p=.03$, odds ratio $=2.38$) categories significantly predicting image selection. With the referent High, the Med. category did not significantly predict image selection ($p=.33$, odds-ratio $=1.41$). The results indicate that the images derived from the Med. and High condition were judged as being *inspiring* by the new group of students significantly more often than images from the Low condition.

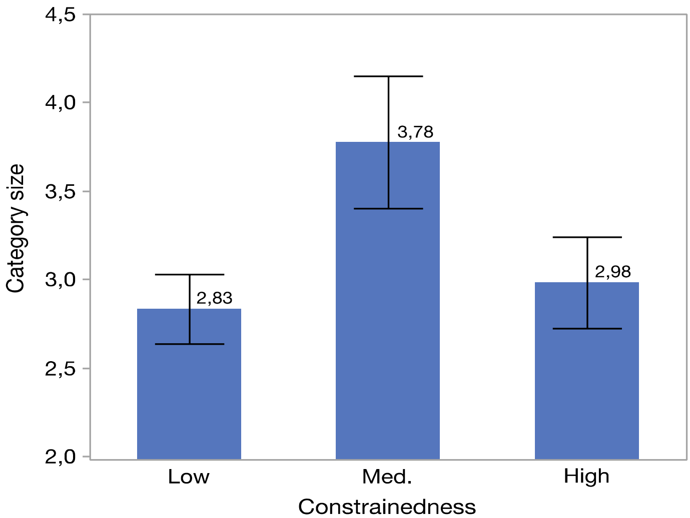

Fig. 6 Mean category size in the image sorting task by level of constrainedness

Part IIb: Effects of constrainedness on the number of ideas generated by a new group of participants

New groups of students were asked to ideate for 5 min using a complete set of Low, Med., or High level of constrainedness images counterbalanced for ordering. Idea generation was recorded per participant and a repeated measures GLM, with group affiliation set as a between-subject factor, showed a significant within-subject effect for constrainedness, $F(2, 56) = 3.24$, $p = .047$. Images from the Low condition led to a mean of 2.9 ideas per participant, while the Med. and High constrainedness images led to identical idea counts per participant, i.e., 3.3 ideas. Within-subject contrasts showed a significant linear $F(1, 28) = 5.02$, $p = .04$, but insignificant quadratic effect $F(1, 28) = 1.57$, $p = .22$.

Discussion

Three distinctly different inspiration search strategies

Our experimental results illustrate a strikingly diverse, and quite distinct, set of inspiration search strategies and subsequent effects on inspiration and ideation resulting from the three constrainedness conditions. This is particularly noteworthy given the fairly subtle experimental manipulation where adding a few key constraint words in the formulation of the creative design task seemed to make a large difference on both individual search behavior and later inspiration selection. As might have been expected, the availability of more constraint keywords with higher levels of constrainedness in the design task prompted a linear increase in search string query length. It is, however, notable that the variance in search string queries was limited across conditions (from 1.9 to 2.7 words on average) compared to the number of available constraint keywords in the design task formulation (from one to 13 main keywords). Even so, for the three constrainedness conditions, distinct search strategy patterns and subsequent effects emerged.

Low constrainedness: divergent search

The condition with the lowest degree of constrainedness (Low) in the design task formulation showed a pattern with a large number of quick and primarily divergent searches without much usage of design task keywords throughout the process. We label this strategy *'Divergent search.'* The very few search strings that made heavy use of design task keywords would be conducted early on and abandoned entirely in the second half of the search. In the search results, only a few images would be clicked for further inspection. The search strategy ultimately led to a rather heterogeneous set of inspirational images, but also a set that to a lower degree would be selected as inspirational by others, inciting fewer ideas in the group ideation session.

Intermediate constrainedness: in-depth, on-task exploration

The intermediate constrainedness condition (Med.) showed a rather different search strategy pattern, which we label '*in-depth, on-task exploration*.' Here, we note what may be characterized as slow, effortful, in-depth search iterations with correspondingly few overall search queries that mainly consisted entirely of words from the design task, especially in the first half of the search (but also with a number of searches with no use of task keywords later on). These search results were carefully screened, with more individual images clicked for further inspection per search, albeit without evidence that the search would continue further downwards on the search result page than the other two conditions. It is noteworthy, and perhaps surprising, that the Med. group would display such continued effort on the search results—even beyond the High group. We speculate that an explanation might be that the participants in the Med. group would consider their search queries *near-optimal*, or even exhaustive, given the search utilization of most constraint keywords in the design task formulation, possibly leading participants to presume that any desirable sources of inspiration should be available among the search results.

This interpretation can be further supported through Perkin's (1994) concept of Klondike spaces based on the fundamental principle "Gold is where you find it" (p. 121). This means that in a search process, "although you can look in more likely and less likely places, you have no reliable strategy that will lead you to the gold," so "You have to invest considerable search in a relatively clueless realm" (p. 122). With regard to the Med. constrainedness group, their dedicated effort to keep using the keywords from the design task formulation in the inspiration search might be explained by reference to Perkins' conceptualization of the 'oasis problem,' which says that "regions of payoff or even promise are hard to leave [...] Even if a rich area becomes nearly mined out, it's tempting to stay and rework it. After all, when will one really find another?" (ibid.). This means that the Med. group might perceive their individual search queries as an 'oasis of false promise' given the built-in bias of reluctance to leave and begin to type in new search terms in Google Images. Conversely, the Low constrainedness group might be facing Perkins' 'plateau problem' where "search processes often cannot tell in what direction to search for increasing promise or payoff" (p. 124). Perkins' point, which is highly relevant to all three constrainedness groups, is that "creative systems discover adaptive novelty [here: inspiring images] through search. Each of these characteristics of a Klondike space works against the discovery of adaptive novelty. The sheer rarity of adaptive novelty makes searches long and rewards sparse" (ibid.). It is notable that the sets of inspiring images in the Med. constrainedness condition were more homogenous than in the other conditions but were still selected often by other students as inspiring, leading to a high number of ideas in the group ideation sessions. One possible explanation for this might be an image familiarity effect, since familiar pictorial images seem to increase the variety (and potentially also the number) of design ideas generated in a task (Purcell and Gero 1992).

High constrainedness: flexible bracketing

The highly constrained condition (High) displayed yet another strategic approach, which we call '*flexible bracketing*.' As in the Low condition, search iterations were quick and numerous, containing a balance of search types (a mix of search queries with and without the usage of design task keywords), both early on and later in the process, leading to few image clicks per search. Unlike the Low condition, the high-paced search seemed to not be caused by a lack of appropriate task-related search terms, since these would be employed both early and later. The higher number of available keywords compared to a standard Google Image search entry may in effect have caused what Perkins (1994) called a '*combinatorial explosion'* of possibilities where keywords could continually be re-combined. Related to his idea of a Klondike 'rarity problem,' this means that the possibility of making "innumerable configurations" in a search activity tends to "generate far too many combinations to be explored by exhaustive search processes in reasonable periods of time" (p. 122).

Here, the resulting inspiring images were heterogeneous (unlike the Med. condition), often selected by others as inspirational, and led to a high number of ideas in group ideation (similar to the Med. condition). The heterogeneous nature of the images in the High condition and the frequent use of random search terms is a bit surprising. The present results do not lend support to predictions that a highly constrained search space will lead to a restricted sample of inspirational sources. On the contrary, our results show that the high number of available search terms in the design task with a High level of constrainedness allowed for *flexible* search behavior and with a *breadth* of searches. This importance of breadth mirrors central findings in the above study by Harms et al. (2018).

A potential preference for three-four word queries

One possible explanation for the slow and continued effortful search strategy deployed in the Med. constrainedness condition might in part be related to heuristics (and biases) resulting from normal Google search behavior. We have not been able to obtain data on search query length specifically for Google Images; however, a standard Google search string entry contains one to seven words with approx. 3.32 query terms on average (Taghavi et al. 2012). Interestingly, Google has a "much higher average than most other search engines and was thus the cause of an imbalance in the overall average of 3.08 terms per query" (p. 166) among all search engines analyzed. The average of the outstanding search engines was 2.74 terms so "Google users have a tendency towards longer queries" (ibid.). It is possible that the finding that the Med. group makes fewer, but more in-depth searches may in part be caused by the fact that the Med. group had available to them from the design task a number of constraint terms similar to a so-called 'standard' Google search. The participants in the Med. condition might have 'dug deeper,' because the Med. constrainedness they experienced matched very well their typical Google search entries. We speculate that the availability of the said number of keywords in the design task may have sparked an individual assumption that no further search strings were needed given the near-exhaustive use of terms in search string entries, akin to a type of framing effect (Kahneman and Tversky 2000; Tversky and Kahneman 1981). Such a situation could possibly have resulted in the observed slowing down of search iteration and in part have led to the more homogenous set of resulting images.

Managing search terms to enter into a 'sweet spot'

As opposed to recent work in game design where an inverted U-shape relationship between a player's choice of game difficulty and motivation has been demonstrated (Lomas et al. 2017), the present study does not conclusively establish a similar, unequivocal relationship between constrainedness and perceived inspiration. As stressed by Teigen (1994), there have over the years been several instances of suggested inverted-U relationships to help explain any number of topics, not least in psychology, and so we acknowledge that one should tread lightly. These concerns notwithstanding, we argue that our findings do lend some support to the idea of a 'sweet spot' of constrainedness in inspiration search.

Participants in the Low condition seemed to deploy a torrent of divergent searches. This might be interpreted as *adding random constraints* to the search activity in order to enter into a 'sweet spot' of constrainedness from the underconstrained (left) side of the inverted

U-curve. On the other hand, while the High condition included longer search queries, these remained rather short (2.7 words on average). In this respect, *bracketing of constraints,* akin to the practice of expert engineering designers working with overconstrained design tasks (Onarheim 2012a), occurred between searches with individual search strings making use of only a small subset of constraints in the form of the keywords stated in the design task. This moving toward the inverted U-curve from the right-hand side suggests that the Med. condition might, to some extent, be seen as a 'sweet spot' of constrainedness in terms of inspiration. Even so, it is notable that the Med. group's slow and effortful, in-depth search behavior led to an image set that was more homogenous than the other two conditions. This invites the interpretation that a *subjectively perceived* 'sweet spot' of constrainedness might in effect cause *less than optimal* search behavior and image selection insofar as a diversity of sources of inspiration is often desirable (Eckert and Stacey 2000; Gonçalves et al. 2014; Mougenot et al. 2008). This underlines the need for more insight into inspiration search strategies and moving beyond what a person might feel as immediately comfortable in terms of constrainedness in a given design task. Such new insights will also be beneficial for future work on a more detailed and comprehensive demonstration of what we interpret as an inverted U-relationship between constrainedness and perceived inspiration in inspiration search strategies in design.

Limitations

Although what we present here is a rather comprehensive study, it has some limitations. The selected participants (n = 39) were all high-school students following a business design course so we cannot estimate to what extent the search behavior observed might apply to professional designers (see Koch et al. 2018). The design briefs, including the number of keywords, were formulated in collaboration with the experienced course lecturer, who vetted each based on the Med. constrainedness category as very typical for a business design task aimed at high-school students undertaking a design education. We can thus only speculate if these levels of constrainedness may be generally applicable, including to professional design, and how they may relate to more advanced design briefs in experimental research, which often emphasize polysemy, innovation, and communication (Sosa et al. 2018). While we have chosen (primarily) quantitative measures, it would be interesting to augment these with more qualitative data, e.g., post hoc reflections. Since coming up with a complete business design is rarely done individually throughout the entire creative process, it would be beneficial to also study how small groups of design students search for inspiration together. Finally, we appreciate that searching for inspiration will often last much longer than the 15-min interval studied here. As Jarmusch (2013) points out, creative professionals such as artists and designers will often find themselves in a permanent inspiration-search mode. This insight is echoed by Mougenot et al. (2008), who, in their study of expert car designers, found that "inspiration does not fit the constraints of a '9-to-5-job' but is rather a continuous, and almost unconscious, activity" (pp. 335–336).

Implications for design research and future work

Until now, there has been surprisingly *little scientific knowledge* of how *inspiration search strategies* are carried out in response to varying levels of *constrainedness* in a creative design task. This is true for the general design research community as well as the specialized field of design education. In this paper, we have shown how search strategies not only target information but *frame the entire design process* in continuation of Schön's work on problem framing (1983, 1992). Also, we have argued that the idea of a *'sweet spot'* of constrainedness (Biskjaer 2013; Onarheim 2012b) might also be relevant to a person's individual level of *perceived inspiration* but with the caveat that this perception might be sub-optimal in terms of efficiency of search behavior. The three distinct inspiration search strategies that we have discerned—*divergent search* (low), *in-depth, on-task exploration* (med.), and *flexible bracketing* (high constrainedness)—are relevant to design researchers as a launch pad for additional work on how to search for and select among the plethora of potential sources of inspiration online for use in a design process. These inspiration search strategies are also relevant to professional designers and, especially, design educators, who often devise and solve various design tasks in which obtaining potent sources of inspiration as efficiently as possible is critical; not just for the purpose of working efficiently but also as a way to ensure a significant learning outcome. By giving all design students—from business design over interaction design to engineering design—more insight into the careful use of inspiration search strategies as a core design skill, design educators might help students avoid the inexpedient, and very frustrating situation where they passively "rely on inspiration to hit them whilst they ponder a blank page" (Bruton 2011, p. 329). Jarmusch (2013) might be right that one should only select sources of inspiration that "speak directly to your soul"; however, the difficult question is still how to find them. In this study, we chose Google Images due to its predominance as a generic search tool. For future work, it would be interesting to also study other online resources such as Instagram, Flickr, or YouTube, since this would shed new light on videos as inspiration in addition to the still images studied here. Finally, it could be relevant to also deploy a more visually-oriented design task.

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