JOURNAL OF
Creative Behavior
Publication of the Creative Education Foundation™

MARION BOTELLA
LÉONORE ROBIEUX
BENJAMIN FRANTZ

How Does a Stone Carver Create? A Participatory Case Study

ABSTRACT

Art and design involve divergent creative processes. Design is a more constrained domain than art. While creativity in some specific domains, such as painting, sculpture, and music, has been widely studied, some have as yet been little explored. One example is stone carving. What characterizes stone carving, as a creative occupation? What is a stone carver's creative process? We set out to answer these questions by interviewing a stone carver about his profession, his process, his productions, and his place in society. In this case study, we examined the stone carver's discourse using a combination of three content analysis software tools. Taken together, the results highlight and detail 3 of the 7 Cs of creativity: the stone carver as creator, his creating (creative process), and his creations (productions) on which the interview focuses. The results of this participatory case study were validated by the stone carver himself. They reveal that stone carving sits at the intersection between handicraft, design, and art.

Keywords: stone carving, process, conception, realization, designer.

Creativity is the combination of originality and adaptiveness (Lubart, Mouchiroud, Tordjman, & Zenasni, 2015; Paulus & Nijstad, 2003; Runco & Jaeger, 2012). Corazza (2016) argues now that "creativity requires potential originality and effectiveness" (p. 262), signifying that an idea may not be creative at a given moment but become so later. Thus defined, creativity can be situated on timescales that are more or less long, and more or less iterative. Creativity has been described in terms of seven components, known as the 7 Cs of creativity (Lubart, 2017): creator (the creative individual), creating (the creative process), collaboration (the collective dimension of creativity), context (the creative environment), creation (creative productions), consumption (the uses of those productions), and curricula (creative training).

While talking about creativity tends mainly to evoke thoughts of art (Schlewitt-Haynes, Earthman, & Burns, 2002; Stanko-Kaczmarek, 2012), it is also expressed in other domains. The 7 Cs have been studied, often separately, in many creative domains, such as art, science, design, writing, music, and cooking. But is it the same creativity that is in play in all areas? In many publications, Baer (1998, 1999, 2010, 2012) has argued that performance and personality traits differ between creative domains. The objective of the present study is to explore a relatively little-studied creative domain: stone carving. We will focus on three of the 7 Cs: the creator, the creative process, and the creations themselves.

We began with the hypothesis that stone carving can be included in the domains of art and/or design. However, defining these two domains is not a straightforward matter. Stecker (2005) presents a literature review on attempts to define art, which ultimately does more to open up the debate than to provide a specific response. In any case, he considers that art must be defined historically and in a way that integrates the full variety of features involved in earlier attempts at definition. These varied definitions highlight the fact that art has not just one value or function, but many. For example, art may be an artist's personal representation of reality (and not a reproduction of reality), allowing them to express themselves and their emotions.

In 2004, Miller proposed to define design as "the thought process comprising the creation of an entity" (p. 4). He explained each of these terms: the "thought" in question consists of insight, intuition, and reason; the "process" is a nonlinear, iterative sequence of events and procedures; the term "comprising" means that it "includes, or contains, every thought and action required to create that which is being designed"; the "creation" is the realization of an "image of possibility" that initiates the creative design process; and the

"entity" is the final product. Bonnardel (2006) proposes another definition of design that clearly connects it with the definition of creativity: "to design is to define the characteristics of an object (or a procedure) that presents a certain novelty and that is adapted to an evolving set of varied constraints" (p. 29).

According to these two definitions, art and design both involve the creation of an object, which can come in many forms in the field of art and which can be understood in a broad sense in the field of design (such as an event, an idea, a procedure). So, while the definition of art emphasizes the artist's expression, that of design emphasizes adaptation to constraints. In this study, we will seek to position the domain of stone carving in relation to these two broad creative domains with particular attention to the 7 Cs of creativity.

FIRST C: CREATOR

The multivariate approach to creativity (Lubart et al., 2015) groups the creator's characteristics into four broad categories: cognitive (intelligence, knowledge), conative (personality, motivation), emotional (traits and states), and environmental (physical and social environment).

The *cognitive* factors are intellectual abilities that favor the emergence of a creative solution (Lefebvre, Reader, & Sol, 2013; Sternberg & O'Hara, 2000). These include the abilities to (a) identify, define and redefine a problem, (b) select relevant information to solve the problem (selective encoding), (c) observe similarities between different domains (selective comparison), and (d) associated the assembled ideas (selective combination), as well as (e) flexibility (Lubart et al., 2015).

The *conative* factors in creativity concern personality traits and motivation. Creative individuals are generally described as open to new experiences (Feist, 1998; Furnham & Bachtiar, 2008; Soldz & Vaillant, 1999; Wolfradt & Pretz, 2001; Zenasni, Besançon, & Lubart, 2008) and tolerant of ambiguity (Sternberg & Lubart, 1995; Zenasni & Lubart, 2001, 2008). They are also characterized by perseverance, individualism, risk-taking, and psychoticism (Lubart et al., 2015). Motivation is also an important factor for creativity (Nakamura & Csikszentmihalyi, 2003).

With regard to *emotional* factors, studies show that individuals with high emotional intelligence tend to be more creative (Guastello, Guastello, & Hanson, 2004) and have personality traits linked to creativity (Sánchez-Ruiz, Hernández-Torrano, Pérez-González, Batey, & Petrides, 2011). Emotional intelligence involves the enhanced perception of the emotional environment, which favors the emergence of creative ideas (Carmeli, McKay, & Kaufman, 2014).

Finally, the multivariate approach also emphasizes environments that offer physical (Dul & Ceylan, 2011) and/or social stimulation that is favorable to the generation and maturation of ideas, which reinforces motivation (Lubart, 1999). The environment includes the social appreciation of creative productions, and social learning to judge creativity (Storme, Myszkowski, Çelik, & Lubart, 2014).

The multivariate approach thus identifies the factors involved in creativity and their interactions. Other elements may also explain individual differences between creators. In a major meta-analysis on personality and creativity, Feist (1998) showed that the personality traits of creative individuals in different domains (art and science) are also different. For example, artists tend to be more affect-driven, emotionally unstable, and anti-social, while scientists tend to be more conscientious.

SECOND C: CREATING, BETWEEN ART AND DESIGN

The creative process is the succession of thoughts and actions that culminates in a creative production (Lubart, 2000–2001; Lubart et al., 2015). This process differs between different domains, notably art, and design. Glăveanu et al. (2013) interviewed recognized experts in multiple creative domains and highlighted both similarities and differences between them. They found that professional artists and designers share characteristics including a strong desire to create, a general processual pattern (idea–work–idea), an influence of physical properties on their production, difficulties with access to tools, and the emotions associated with creation (dis/satisfaction). However, three elements distinguish the two groups from each other: (a) their initial motivation: namely to express themselves, for artists, and to solve a problem, for designers; (b) the difficulties they encounter: namely, access to material for artists, and budget, for designers; and (c) social influences: namely, the key role of colleagues, for artists, and of clients, for designers. The qualitative study of Glăveanu et al. (2013) shed some light on the last of these, social interactions, in the two domains. They found that colleagues enable artists to exchange, discuss, and adopt other points of view on creation. By contrast, designers' constant interactions with clients impact their creation—particularly at the outset, when

the client sets out the guiding ideas or goals while leaving the designer some freedom, and at the end when it is time to decide whether the work is finished.

Consequently, models of the creative process in these two domains are not equivalent. For example, in the domain of art, Mace and Ward (2002) describe a four-phase model on the basis of interviews with professional artists. The artistic process begins with the *conception* of the artwork. Here, the work is introduced by a more or less vague idea or impression. The second phase is idea *development*. Here, the artist structures, enriches, and restructures the idea. They also identify possibilities for the development of the work based on their ideas and their feelings. Furthermore, they make decisions, both implicit and explicit, as they observe their work. This evaluation pushes them to consider which ideas, expressions, metaphors, and analogies they want to actually use, and which they prefer to abandon or set aside for use in future works. The third phase is *making* the artwork. In this step, the artist transforms the idea into a physical entity. The fourth and final phase is the *finishing* and resolution of the artwork. Here, the artist evaluates the production, and they may choose to put the production process to an end, continue it, abandon it, or postpone it. They may choose to store or destroy the work; if they consider it successful and satisfactory, they may choose to exhibit it. Recently, Daniel (2020) sought to quantify artists' characterization of their creative process using a specially constructed questionnaire. A total of 339 artists responded. Daniels found that 72% of artists made plans (although these could change over the course of the process of creation), 82% consider art as a means of self-expression, 63% are motivated to "move" their audience emotionally, physically or spiritually, and 79% indicated that inspiration came at random.

In the domain of design, based on a literature review of the design process, Howard, Culley, and Dekoninck (2008) proposed an eight-process model. The first is formulation: in this operation, design students translate the desired function (a constraint) into a behavior that is expected to enable it. Next comes synthesis: the students transform that expected behavior into a potential structure. The third operation is analysis, where they derive the actual behavior that would result from that structure. They then evaluate that behavior in relation to the expected one (process 4). The next operation is to produce documentation describing the design for construction or manufacture (process 5). The final three operations are three different types of reformulation. If the behavior produced by their proposed structure is unsatisfactory, they change the structure (process 6), the behavior (process 7), or the function (process 8).

Few studies have compared the respective creative processes in art and design. However, Botella and Lubart (2015), looking at a population of students, found that design students begin by analyzing constraints, whereas graphic art students are particularly influenced by chance events and constraints emerge only at a late stage, when they are finalizing the work. In design, constraints are at the heart of the process that emerges out of the definition of the problem and that leads to many stages (insight, reflection, judgment, implementation, chance, and convergent thinking). These differences in the process seem to be linked to the different levels of constraints associated with different types of creations.

THIRD C: CREATIONS

Different object(ive)s in art and design

Not only do artists and designers have different creative processes, but the objects they create also pursue different objectives. Deforge (1990) distinguishes between *works* and *products*, depending on function. When the object is dominated by its function as a sign, then it is a work; when it is dominated by its use function, it is a product. On the basis of this theoretical framework, Didier (2017, 2018) and Didier and Leuba (2011) have proposed a "Design–Realization–Socialization" model of creative production. According to this model, the design consists in anticipating the object's use and context (its socialization) and shaping the object that will be produced (realization) on the basis of that anticipation. This forms a loop where socialization "feeds back" into design. The creator can follow a loop that gives priority to the object's function as a sign, creating a work, which responds to their desire for expression and communication with others. Or they can choose a loop that gives priority to the object's use function, yielding a product, something intended above all to respond to a need or to be usable. Didier and Bonnardel (2020) argue that because the designer's process aims both at creating a useful object and at communicating with others, it takes place at the intersection of the two loops.

The role of constraints in creativity

Constraints are strongly associated with the definition of creativity (Lubart et al., 2015). As we saw above, creativity is defined by two criteria: originality and adaptation. The second of these implies that to be

creative, ideas must respond to the constraints of the situation (Lubart et al., 2015; Runco & Jaeger, 2012). Constraints limit the options available for the design of an object (Bonnardel, 1989). They can be external, prescribed directly by the problem, or internal, added by the creator (Bonnardel, 2006). These constraints are not all equally important. Some are obligatory, others guide design work on a discretionary basis, and others still are flexible—that is, they are supposed to be obligatory but can be circumvented (Vessey, Jarvenpaa, & Tractinsky, 1992). Bonnardel (2006) also explains that constraints act at different moments in the process: at the beginning, as the search for solutions begins, and at the end, when it is concluded. A large body of evidence shows that greater restrictions and constraints enhance creativity (Moreau & Dahl, 2005; Stokes, 2005) and this, whether the constraints are internal or external (Haught-Tromp, 2017).

In art, the main focus is usually on originality, while adaptation to constraints can be minimized. This is partly due to the implicit acceptance of the applicable constraints. For example, a painter may have so deeply integrated the size of the canvas, or the limitation to two dimensions, as elements of their creation that they may not even perceive these as constraints at all. But in design, as we have seen, the constraints continue to be a focus throughout the process (Botella & Lubart, 2015; Howard et al., 2008).

AIM OF THE PRESENT STUDY

This literature review has highlighted the domain dependence of the creative process. We have seen that studies highlight some similarities between the creative processes of artists and designers, but also some important differences. These differences may, first of all, be due to the object's main intended function: artists focus predominantly on their works' function as a sign, while designers focus mainly on their products' use function. Moreover, the design seems to involve more constraints than art.

While the creative process in various specific domains (painting, writing, design, etc.) has been investigated (Glăveanu et al., 2013), many other domains that involve a creative process remain largely unexplored. It is thus essential to study new creative domains in order to capture the singularity of the associated creative process. For this purpose, we have chosen to study the field of stone carving that has not yet been investigated in detail. Indeed, we postulated that this field could be positioned between art and design because of the important constraints of the craft. According to the employment orientation website of the Île-de-France region, "The work of the stonemason or stone carver lies halfway between that of the builder and that of the sculptor. They cut and carve blocks of stone for use in the construction, decoration and restoration of monuments, staircases, chimneys and gravestones" (https://www.oriane.info/metier/tailleur-de-pierre/35).

The constraints on stone carving are mainly material. Stones are natural products extracted from the Earth, and the characteristics of each block of stone are unique. Stone varies along many dimensions, including color, veins, grain size, friability, distribution of hardness, micro-fracture patterns, etc. (Rockwell, 1990). The importance of the uniqueness of each stone is highlighted, for example, by the fact that many stone carvers use the block itself as the starting point for a new piece (Constantine, 2012). Rather than basing a future work on an idea or a concept, they base it on the stone block itself.

Stone is a relatively hard material (ranging from 3–4 for limestone and marble, to 6–7 for granite, on the Mohs scale of mineral hardness). Carving stone is thus a slow process. It takes time, a lot of time. Moreover, the impossibility of adding material (unlike with clay, for example) makes every action a definitive one. The definitiveness of each action leads to at least two approaches, which usually coexist in each sculptor. One is the tendency to let oneself be driven by what happens: that is, to adapt and modify the project with the outcome of each stroke or cut, whether or not it was intended. The other is to plan each action carefully, because errors are costly, and the more the project advances, the greater the loss. Glue can mitigate the consequences of a break but cannot perfectly correct it. And the inability to add material has other effects, which are clearly visible in any domain based only on removing material (milling, machining, woodcarving, etc.). Mental visualization needs to work like a negative, and it is highly demanding, because as the stone is removed, so are the points of reference. Moreover, some shapes that are perfectly feasible in additive materials are simply impossible in stone (like a hollow sphere, for example), which reduces the range of possibilities.

The principal objective of the present study is to identify the creative process in the domain of stone carving. Considering how little investigation there has been into creativity in this specific domain, this study has the following secondary objectives: (a) To identify the attributes/specificities of stone carving as a creative occupation, and (b) to understand the specific creative process of this domain. Through the application of stone carving, this study aims to grasp the differences between art and design concerning the different

dimensions of creativity, facilitating the differentiation. Based on the definition of stone carving, we hypothesized that stone carving may represent a superposition of existing creative domains, in particular between art (because the work of a stone carver could be similar to that of a sculptor) and design (because the work of a stone carver includes many constraints as the functional use of the object).

METHOD

To meet these objectives, we conducted a single qualitative case study. This method allows for the rigorous, in-depth empirical study of a phenomenon by studying an identified example in its context (Creswell & Clark, 2017; Crowe et al., 2011). In our case, this means investigating and exploring how a professional stone carver goes about his work. For this study to be able to serve its purpose in theoretical verification and development, careful attention was paid to the essential characteristics of case studies (Eisenhardt & Graebner, 1989; Fielding, 2012; Flick, Garms-Homolová, Herrmann, Kuck, & Röhnsch, 2012). These include theoretical sampling, the involvement of multiple investigators, the iterative performance of analyses within the case using divergent data analysis techniques, and attention to the logic of replication between cases in order to develop, extend, and refine the theory.

Our study also draws on the tools of participatory research, with an interactionist approach that allows for collaborative relations between actors and that makes it possible to take into account their varied contexts, needs, and constraints (Le Breton, 2004). After beginning as a participant, the stone carver and researcher Benjamin Frantz then took on different roles as the study progressed: first expert consultant, and ultimately analytical and editorial collaborator (Cornwall & Jewkes, 1995).

CASE STUDY PRESENTATION

For this single case study, we chose to interview Benjamin Frantz, a French 35-year-old stone carver. The other authors chose this participant because, in addition to his work in stone carving, he also has training and experience in psychology, enabling him to actively participate in the study. Indeed, before his stone carving career, he had a master's degree in cognitive psychology. For rather 10 years, he was a Do It Yourself enthusiast and made numerous projects, as a hobby, in many fields (woodwork, leather work, tailoring, pastry, etc.). He then changed his career to stone carving, motived by a will "to switch from hobby to professional" and "to explore a totally unknown field."

He trained in stone carving in Canada and acquired a professional diploma (DEP) in the domain in 2018. He has since worked part-time in a company making furniture and other domestic objects (tables, pots, trays, etc.), taught stone carving (initiation for adults and substitute teaching on the diploma course), and pursued personal projects. In stone, he has produced various objects from drawings, such as a fountain, coffee tables, and engravings (see Figure 1 for examples). His personal projects are based on interactions between stone and light, and the fact that light can drastically change the appearance of stone. He has designed and produced various stone lamps highlighting the particularities of different materials (granite, quartzite) through transparency effects. To allow light through, the stone must be made particularly thin. The constraint is then that the stone becomes very fragile and the final assembly must be very precise, with the joints being particularly narrow (see Figure 2 for examples).

FIGURE 1. Examples of objects produced by the participant from drawings.

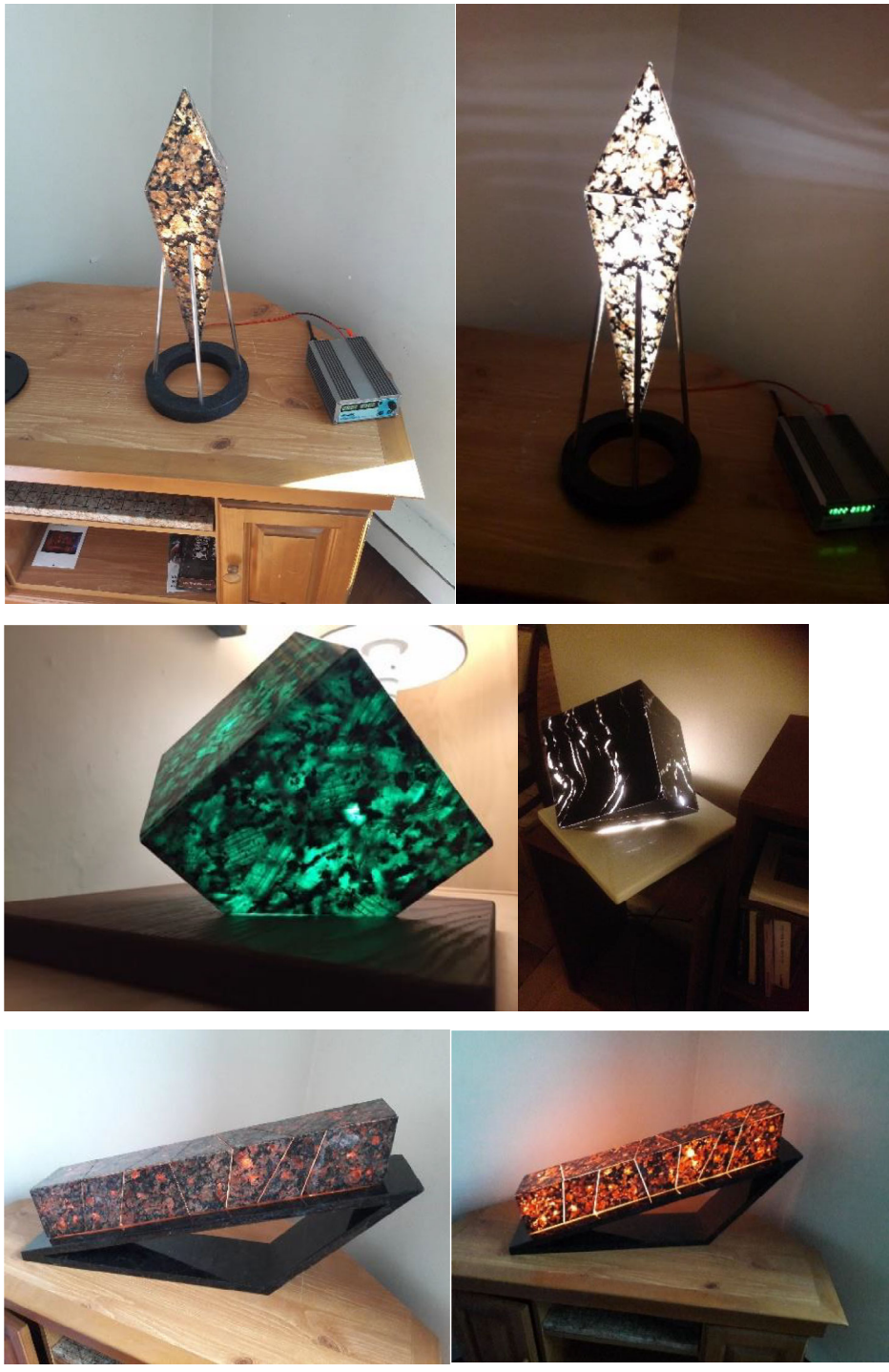

FIGURE 2. Examples of lamps produced by the participant based on the stone-light concept.

INTERVIEW GUIDE AND STUDY DESIGN

The interview guide is taken up from previous studies (Botella et al., 2013; Glăveanu et al., 2013). It consists of four parts: a general presentation of the creator; a description of his working conditions; a precise description of his creative process, initially in a general way, and then by describing a particular creation using the critical incident technique (Flanagan, 1954); and reflection on the stone carver's place in society.

First of all, Benjamin Frantz was contacted and signed an informed consent form to be a non-anonymous, active participant in the case study. The interview was conducted in French[1] by the first author, and took place by videoconference, due to geographical distance (France-Quebec). The interview was recorded and lasted 96 min. It was then transcribed literally, that is, writing out all words and using conventional punctuation (Blanchet & Gotman, 2007). It was only after the interview that Benjamin Frantz was integrated into the research team. He then took part in the verification of the results and the writing of the article.

This design allows to implement a cross-look as reflexivity at 2 levels: (a) the participant researcher on himself and (b) between the participant researcher and the other members of the research team. This approach enabled to achieve greater reliability of results while assuming a certain degree of subjectivity.

CONTENT ANALYSIS

The content analysis is directed at the two objectives of the study: understanding stone carving as a creative occupation and characterizing the creative process that it involves. The framework for the analysis is grounded theory, an inductive empirical approach first described by Glaser and Strauss (1967). Three analysis software packages were used to triangulate the data: NVivo, Tropes, and IRaMuTeq. The principle of these three tools is the same: to construct thematic clusters, and possibly subclusters, in order to organize the discourse.

Thematic coding: NVivo

The first software used was NVivo (QSR International, 2020). This software allows classification to be created by hand based on parts of a corpus. For this analysis, two psychology students, not specialized in content analysis or creativity, began by reading the interview multiple times, and then worked together to propose an initial classification. This first, bottom-up reading revealed key elements from the corpus. The first two authors, the first an expert in creativity and the second in content analysis, then worked together on this classification to give it its final form. This double coding served to construct the classification on the basis of the content, rather than theoretical considerations.

Cognitive discourse analysis: Tropes

In parallel, we used Tropes, a software tool based on cognitive discourse analysis (Ghiglione & Blanchet, 1991; Ghiglione, Kekenbosch, & Landre, 1995). This semi-automated discourse analysis tool begins by counting word frequencies and then allows the user to manually create a classification. This classification was created by a student, who is not an expert in the field, along with the first author.

Automated analysis: IRaMuTeq

Finally, the interview was analyzed with the IRaMuTeQ® software (Ratinaud, 2009) using the method described by Reinert (1983). This method involves quantitative content analysis based on vocabulary, such that the data can be organized and a way that makes sense. This automated analysis is based on the frequency of terms and uses a recursive, inductive approach that identifies and quantifies co-occurrences (Delefosse, Bruchez, Gavin, & Stephen, 2015). Descending hierarchical cluster analysis then allows the discourse to be organized into clusters identified by the specificities of their vocabulary (Kalampalikis, 2003). Each cluster represents a key idea in the corpus.

Summary of the three analyses

The two first authors and the student who worked with Tropes collaborated to integrate the three analyses. The three word clusters generated by IRaMuTeq served to guide the integration of the classifications produced with NVivo and Tropes. Since Tropes provides a lexicometric analysis, its classification was readily

[1] The verbatims presented in this article were translated by a professional and the translation was checked by Benjamin Frantz to guarantee the accuracy of the content.

applicable to the words in the clusters identified by IRaMuTeq, and then to project the classification from NVivo, whose analysis is built on parts of speech, onto it.

RESULTS

The descending hierarchical cluster analysis conducted with IRaMuTeq highlighted three distinct clusters that served as a basis for the classifications produced with Tropes and NVivo. The first cluster, explaining 27.82% of the variance in the corpus, relates to the *creator*, and to stone carving as a creative occupation. The second, which explains 42.48% of the variance, corresponds to *creating*: that is, to the creative process. The third and final cluster, explaining 29.7% of the variance in the corpus, concerns *creations*: the stone carver's productions. The division of the discourse into these three clusters is coherent with the structure of the questions in the interview guide, which address the specificities of stone carving as a creative occupation, the creative process that is involved, and examples of productions using the critical incident technique (Flanagan, 1954). Below we present details on each cluster, including excerpts from the interview for illustration. We also present a schematic visualization to show how the elements may be organized within each cluster.

CREATOR: PROFESSIONAL CONSTRUCTION

This cluster explains 27.82% of the variance in the entire corpus. Our synthesis of the three content analyses identified six major categories of discourse concerning the stone carver's professional development within this cluster: training, materials, motivation, field, the balance of salaried employment and independence, and identity as a stone carver (see Figure 3).

First of all, speaking of his *training*, Benjamin Frantz described his one-year course in Quebec as "very eclectic and quite complex" and said that it allowed him "to acquire all the techniques used to work in stone." He also distinguished between the theoretical knowledge that he acquired in the course and the practical skills that must be developed in order to carve stone. The theoretical knowledge includes "all the steps you need to carve stone [. . .] geology for the composition of different kinds of stone, their physical characteristics, their resistance, how they behave as they're carved, as they're cut, how they break, their weight, their density, their colors, their origin, etc. [. . .] There's also all the work of extraction. What do you have to do to extract the stone, what techniques are used, what equipment is used." A short training course is enough to master these theoretical foundations. However, acquiring the practical skills, the manual movements involved in stone carving, takes considerable time, experience, and practice: "Stone carving, like most manual trades, requires you to acquire a set of skills, know-how, techniques, habits, precise movements of

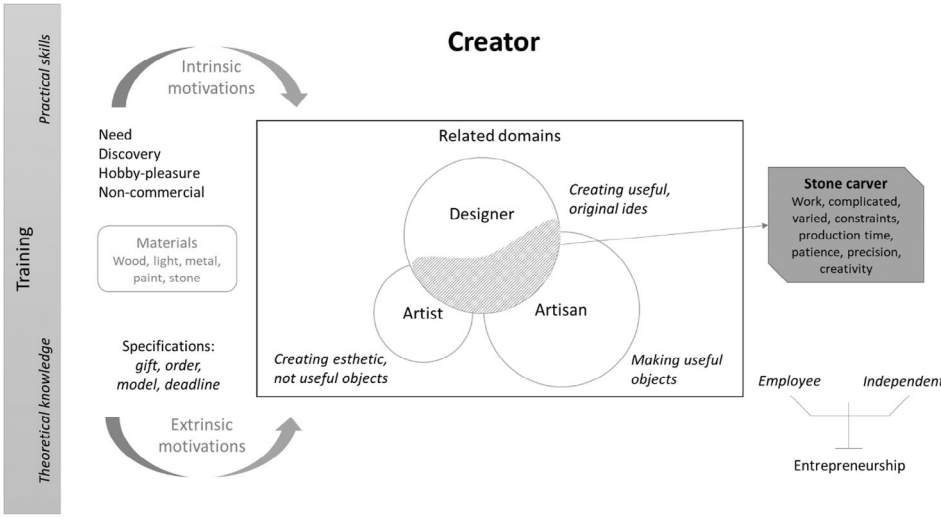

FIGURE 3. Schematization of the stone carver as a creator.

the hands... and that, all that procedural learning, is something that necessarily requires repetition and time. So to become really skilled, it definitely isn't enough, but to know how to do it, it's enough." The training he received thus provided him with sufficient theoretical foundations, but he developed his skills later, with practice and experience.

A second category of discourse focuses on *materials*. It was identified by IRaMuTeq and detailed in the analysis with Tropes but did not emerge in the NVivo analysis. This category evidently covers stone, blocks of stone, different types of stone (granite, marble, etc.) but also other materials that Benjamin Frantz uses, such as wood, metal. and paint. The focus here is on all the specific materials that he uses and that characterize his work as a stone carver.

The third category covers both his motivations for training as a stone carver and the *motivations* that drive his work. We divided this category into intrinsic and extrinsic motivations. Speaking of his intrinsic motivation for choosing stone carving, Benjamin Frantz said: "I wanted to do something that would be in a domain that I wasn't familiar with. Stone carving was something I knew nothing about, something manual and something complex, I mean that involves varied enough types of activity." This general motivation to discover previously unfamiliar things can be seen in all of his productions: "One of the things that doesn't interest me personally is doing something I've already done. So personally I tend to spend a lot of my time doing things I've never done, and that I don't know how to do, and so that I'll be learning how to do. So that's one of the drivers." He associates this desire for novelty with the notions of a hobby and of pleasure ("Personally I want to do cool stuff. It's pretty simple, right?"), and of not having to be profitable—that is, not having to sell his work to live ("For my creativity I think this is extremely important, not having to make a profit"). He was also driven to create these lamps by a need because he did not have a lamp in his house ("The basic reason is that at home I had no bedside lamp, I had no lamp and it was a pain [...] I like making my own stuff, and so I said to myself, 'I'm going to make a lamp', and it started from there"). The extrinsic motivations lie in the specifications that his productions must meet. These can be based on an order, which may include a model that must be followed or a precise deadline to be met, or can emerge as part of a gift that he wants to give someone. One example he described was a time when his task was to produce an object for the school. Note that, in addition to the specifications directly given by the institution, such an order involves other constraints that the creator can deduce: "I tried to figure out something that would work to decorate the interior of a corridor in a school. So it had to be something that wouldn't be totally crazy in terms of representation." If the goal is to create a gift, this may also make a difference in the production. In this case, Benjamin Frantz sets himself specifications based on the expectations of the intended recipient ("For example, I made the lamp that I made thinking that it would be a gift. I knew who it was for and I knew I wanted to make a lamp").

For him, the motivations that guide his production involve finding a *balance between his status as an employee and as independent*: "I work half-time so I have what I need to pay my bills, and so the rest of the time I do other things that I enjoy." His status as an employee gives him not only financial security but also access to a workshop and equipment; while his status as an independent creator gives him the freedom to do what he pleases.

Over the course of the interview, Benjamin Frantz explained how he positions himself with respect to *associated creative domains*: craft (or artisanry), art, and design. In his view, "art is guided more by a concept that is translated into an image." That is, artists produce works that are not obliged to be useful. The notion of utility features in his definition of design ("You take an object that's going to perform a function"), which is limited exclusively to conception ("It's just that design for me is the conception of the object, not the making of it"). Finally, the craft is the making of a useful object: "Craft is guided more by the quality of the production of the object: the object is made in a way that's efficient, precise, etc." Benjamin Frantz positions himself more as an artisan/craftsman, accepting a role as a designer to a limited extent and rejecting the notion that he is an artist: "I don't consider myself an artist. I consider myself more as an artisan, and maybe a designer, in the sense that my productions or what I want to make are largely guided by a sense of utility. I have relatively little interest in just making a work that isn't useful, or rather I think that an object, an interior object, has to be useful, not just to be used as a decoration, just to be put somewhere and that's it." The three connected domains of craft, art, and design shape his identity as a stone carver. Craft leads him to produce useful objects ("My productions are largely guided by a utilitarian aspect"), art leads him to create esthetic objects ("You try to make the object esthetic"), and design leads him to create original objects ("If it's commonplace it becomes less interesting, so it has to be an idea that's original, or let's say rare, not something that's been seen too many times").

Finally, the last category relates to his *identity as a stone carver*. Its essential characteristics were identified by all three software tools, but here, the Tropes analysis provided the most detail. Stone carving is a particularly lengthy process ("The time investment is really large"), and thus requires patience ("There's a notion that's very important when you're working in stone, the first is patience"). The time and patience derive from the fact that work in stone can only subtract, never add. There is no room for mistakes, and precision is a required characteristic ("You can't make mistakes, because in general, you have a block, and you just can't mess up. If you mess up it's all over, and so it's very stressful in the parts that are tricky to do"). Being a stone carver is thus a complicated business, involving numerous constraints. It is also highly varied work. Stone, by all its combinations of characteristics, presents many interesting options that expand the field of possibilities to create an object.

CREATING: THE CREATIVE PROCESS AND THE FACTORS INVOLVED IN STONE CARVING

The second cluster explains 42.48% of the variance in the entire corpus. In keeping with his tripartite division of the work of the designer, the artisan, and the artist, Benjamin Frantz's creative process is divided into three major steps: (a) conception, or design (the work of the designer), (b) realization, or making (the work of the artisan), and (c) to a lesser extent, postproduction (the work of the artist) (see Figure 4). Each phase can then be divided further into substeps.

The first phase, *conception*, begins with a core idea or a concept that will not change as the process goes on: "Basically, how I personally proceed is: I have a concept that's vague, a little like a general constraint. The example is that I want to work on light and stone." Second, he explores the concept from all angles in search of a good idea: "What is it that generates that idea? For me, it's a lot of probing, a lot of trial and error." This exploration of the concept can be a conscious, active search for ideas—for example, by browsing the internet in order to get a sense of the field of possibilities ("One of the things I often do is I've looked at what's possible, I've seen a lot of things that never exist, that don't exist, I mean I've thought of things that don't exist and that in theory are possible nonetheless"). Or it can be unconscious, during the incubation phase ("And then it stayed there for a bit and then a bit later I said to myself. . ."). After developing the broad outlines of the project during the search or incubation phases, it becomes possible to detail and specify the concept: "There's a lot of excitement, energy, that develops once you've got the concept, especially in the phase where you're searching for the details of the thing that will make the object cool." The third step is illumination: "And then all of a sudden it hits you, illumination. And I say to myself that's it, that's what I want to do." Like the subphase of exploring ideas, illumination can be provoked either by

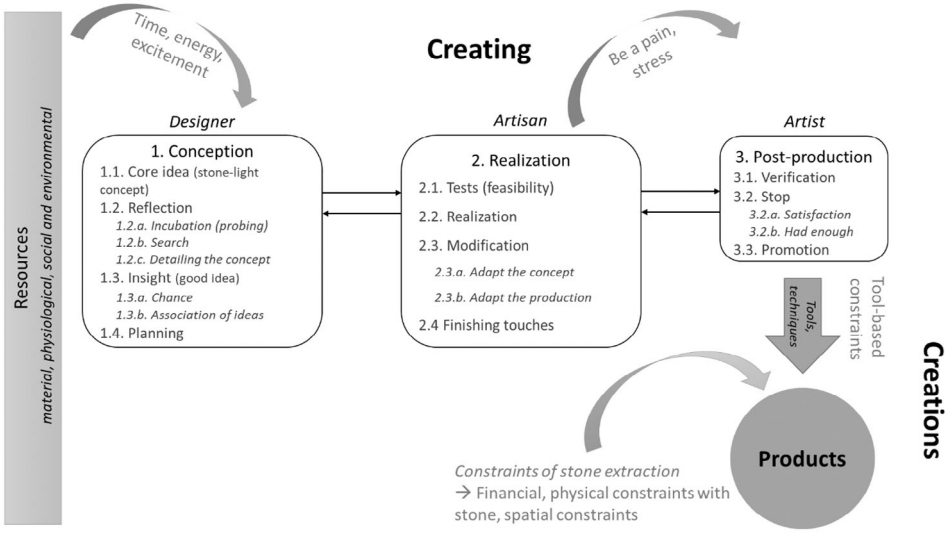

FIGURE 4. Schematization of the stone carver's creative process (creating and creations).

associating two commonplace ideas and arriving at an original one ("There can be a good idea that emerges by bringing together two things"), or it can arise by chance ("By pure chance, a year later, I came across [. . .] and I found it a really good idea. I said to myself okay that's it. That's a good thing"). Fourthly and finally, when Benjamin Frantz has hit on the right idea, he must plan the project. In this phase, Benjamin Frantz produces drawings and plans, attempting to visualize the result in order to refine the details of the project ("What am I going to make exactly, what's going to come out of it, I try to imagine, to visualize how it will look").

Then comes *realization*, a step that, in Benjamin Frantz's view, is artisanal work. First, because stone carving is subject to numerous constraints, which we will look at in detail in the next section, he carries out tests that allow him to determine what is or is not feasible, because small changes have major implications: "In the way that I work, I always do quite a few trials and tests first, which do take time, but which allow me to see that okay, this is possible, that will cause breakage, here chamfering isn't possible on this type of stone because it splinters all over the place, etc. So I do tests on it so I don't definitely waste my time later." Second, there is the making of the object as such, which consists in transforming the project into a tangible object: "There's the whole phase of carving in itself." The Tropes analysis shows that this phase consists in assembling, hollowing, producing, forming, bringing to light. This step is particularly stressful and "a pain" Third, failures can occur, implying either that the concept must be adapted and plans thus revised ("When I get it wrong, because that happens, I make little changes to the form, the concept, things like that") or the production adapted, meaning that the concept is maintained, but certain techniques are ruled out ("So at the outset I wanted to do a rustic finish. In the end, during production there were too many different breakages. So in the end we did a different type of finish"). On Benjamin Frantz's view, adapting the concept is common in the domain of art, but artisans are more likely to adapt their production ("An artist might change their plan along the way—'Oh shoot, I went too far, ah well it's okay, I'll cheat a bit and sort it out, I'll change my concept a little bit and then it'll evolve and it will work out in the end'. But the artisan, typically, will go 'I went too far, well, I have to start over, because it doesn't fit with the plan anymore'. In reality there are lots of techniques to cheat a bit, sort out a problem."). At this point, it is worth noting that Benjamin Frantz does not totally adopt the attitude he attributes to the artisan, when he indicates that it is possible to "cheat a bit." Here he instead takes up the artist's stance. Fourth, there are finishes or details that were not necessarily planned at the outset, which are added at the end: "Then there's a whole bunch of stuff that I can add later on, little details like coloring, like what type of finish I want, is it polished? Is it burnt? Is it smooth? Does it look more sawed? Do I leave tool marks? That sort of thing. That's more in the details later for the finish."

Finally, the last step in the creative process of stone carving is *postproduction*, which, in Benjamin Frantz's terms, is closer to the artist's work. The first step in this phase is verification, as highlighted by the analyses produced using Tropes and IRaMuTeQ. This consists in making sure that production is successful, that it works and has yielded good results. Second, production comes to an end if he is satisfied or pleased, and finds the object "cool" ("I'll start with the end: satisfaction, contentment, pride. That's when it matches"); or if he no longer wishes to take risks and has had enough ("Or maybe I say to myself this is going to be too risky, I don't want to scrap my piece, so I'm going to stop. I won't go any further. I would like to do something a little finer on a piece like this because I think the result would be better, but in the end I don't do it because I'm too scared it will break the piece"). Finally, there is promotion. This can take two forms: either modifying the environment to showcase the object (for example changing the lighting around the object, moving it closer to or further from the wall and thus making use of the direct/indirect light contrast), or giving it a meaning a posteriori. During the interview, he described how he came to tell a story about an object in order to persuade someone of its value: "I spoke exactly like that with one person, and it was clear that I had to talk to him about the sort of artistic side. So in the moment I came up with a story." The process behind this interpretation is the same as that of the art critic, who offers their vision of the work independently of the artist's own.

In addition to these three broad phases, this second cluster also includes the *resources* that support the stone carver's creative process. For one, Benjamin Frantz mentioned material resources: how he takes advantage of elements of the environment ("For example I would look in the courtyard of the workshop to see what blocks of stone were available"). For another, he spoke of social resources, like support from classmates and teachers when he was in training, and more recently from colleagues and from people in general ("I talked about this with the prof. He'd never seen super thin pieces like that, he had absolutely no idea whether it would work or not, and so all that gave me some validation for my idea that it could be good"),

and even the absence of people to disturb him ("The night time is pretty good because at night you can stretch it out pretty far, much further than you think in general, and there's nobody there to come interrupt what you're doing"). Finally, he explained that drugs and alcohol interfere with his creativity.

CREATIONS: PRODUCTIONS AND THEIR ENVIRONMENT

This third and final cluster, for *creations*, explains 29.7% of the variance in the corpus. It concerns the stone carver's productions and the external constraints that influence his production.

It was mainly identified by the analyses with Tropes and IRaMuTeq. In it, Frantz speaks of his *productions*: lamps, of course, and furniture, as well as specific objects such as a maple leaf, a drop of water, an egg, or a clock to illustrate his work. This category also includes tools, with the use of "machinery," "hammer," "tool," "sandblasting," "diamond," and "setup." Finally, it also includes techniques. These can be separated into production techniques, where IRaMuTeQ includes verbs such as "working," "putting," "cutting," "using," and "going," and finishing techniques involving "coloring," "painting," and "traces."

Finally, this cluster includes the many *external constraints* that influence production. First, this includes environmental constraints, the context in which he creates (workshop, light, space): "Basically, I've always worked in workshops where there's no external light source, there's no light. . . there are practically no windows. So it's always with electric lighting." Second, it includes social constraints such as the number of people involved in a project: "There were only four of us who could work on it." Finally, it covers the material constraints inherent to stone carving that derive from the extraction of the stone itself. Some are major obstacles that can even be completely incompatible with a concept, such as those relating to light (some types of stone are too opaque to let light through and thus to work for his initial stone-light concept), financial constraints ("One thing that gets in the way a lot is the accessibility of materials and tools. That is, if I don't have the option, then I can't do it, and that's very frustrating and it keeps me from making some ideas a reality. I mean there are things I'd like to do but that I just can't do because I can't physically make them, so that's an obstacle, a major obstacle"). The effect of other constraints is more to orient his creativity, like those linked to the stone in itself (its color, density, fragility, transparency) or the spatial constraints that give the stone its dimensions and form ("I want to hold on to that roundness to maximize the usage of the stone and lose as little as possible, so to maximize the size of my object I'll go for something that's round").

DISCUSSION

Creativity, and more specifically the creative process, varies between creative domains. The objective of this study was to shed light on creativity in stone carving, a little-studied domain. What are the specificities of this creative occupation? What is a stone carver's creative process? To answer these questions, we interviewed a stone carver about his creative processes and products. We then combined three content analyses in order to position the domain of stone carving more precisely with respect to two broad creative domains: art and design. Here we will discuss the three clusters identified in the specific case of stone carving: creator, creating, and creations, three of the 7 Cs of creativity (Lubart, 2017).

THE STONE CARVER AS CREATOR

Besides being a creative occupation, stone carving is a manual activity. As such, while formal training provides theoretical foundations, practical skills cannot be entirely grasped through studying. Moreover, given the manual nature of the domain, it is unsurprising that the stone carver's discourse often referred to materials. As the name indicates, stone is an essential element for the stone carver. But a specificity of Benjamin Frantz's own creative practice is that he also works with other materials, such as light, wood, and metal.

In this first cluster, we also identified both intrinsic and extrinsic motivations. The stone carver's work can be guided by an external order, which brings precise specifications; or it can be guided by an intrinsic motivation such as a need, the desire to discover things that do not yet exist, or pleasure. Non-commercial work is a major element of his stone carver's identity. However, as we also saw, stone is a costly material. Thus, to take pleasure in his productions, Frantz has sought to strike a balance between his statuses as an employee and as independent: one to achieve financial security, and the other to be able to create without obligation. There are several elements here that echo the work of the designer. Interviews with expert creators in different domains have shown that both artists and designers are motivated by the desire to create, but that artists are mainly driven to express themselves, whereas designers are mainly driven to solve a

problem (Glăveanu et al., 2013). Moreover, designers spoke of two major obstacles to their work: problems with tools and with costs. Here, Benjamin Frantz's work is closer to that of a designer, both in what drives his creation and in the obstacles he encounters. In his discourse, he emphasized the view of his work as craft, rejecting the notion that he is an artist and accepting a view of himself as a designer only to a limited extent. However, the relation between his work and identity as a stone carver to these creative domains is less sharply defined than this. According to Benjamin Frantz, although his primary motivation is not the object's esthetic character (artist) but its usefulness (artisan) and originality (designer), his productions are nonetheless guided by esthetic considerations, and in particular by the desire to please himself ("There are several things. The first is the esthetic aspect. Do I find it pretty? I don't give a crap about how others might conceive it, perceive it. Do I find it beautiful myself?"). He thus also positions himself as an artist. In addition, Benjamin Frantz sees himself as an artisan. In his view, the artisan is a maker of physical objects; and he does in fact devote a large part of his creative process to realization. His positioning as an artisan is coherent with his motivation to produce precise, useful objects. Finally, Benjamin Frantz accepts the possible view of a part of his work as design work. As he sees it, the designer is the one who conceives the project and the artisan is the one who makes it. This clear distinction between the two roles was already and concisely resumed by "Design Proposes. Workmanship Disposes" (Pye, 1968, p. 11). We also saw, in dividing his creative process into phases, that a substantial part of his time is devoted to the work of conception. In the end, we conclude that his identity as a stone carver sits at the intersection of craft, design, and artistry, but that the three are hierarchically organized.

Finally, out of this first cluster emerged all of the characteristics of stone carving as an occupation: it is varied, complicated work, involving creativity, precision, patience, and time, and subject to numerous constraints. The importance of constraints has already been demonstrated in other creative domains (Moreau & Dahl, 2005; Stokes, 2005), and particularly in design (Botella & Lubart, 2015; Howard et al., 2008). Indeed, constraints correspond to the criterion of adaptation that features in the definition of creativity (Lubart et al., 2015; Runco & Jaeger, 2012). Because in stone carving it is not possible to add, only to subtract, it is understandable that it involves such long, patient work. And the more time the creator spends working on a product, the less inclined they will be to take risks, as a mistake may destroy it and mean having to start over from the beginning.

This cluster linked to the creator thus groups together different factors, in accordance with the multivariate approach to creativity (Lubart et al., 2015). The stone carver's training represents the acquisition of knowledge, and thus cognitive factors. Motivation, an important factor for creativity (Nakamura & Csikszentmihalyi, 2003), and features of the stone carver's identity (patience, precision) represent conative factors. The materials involved are environmental factors. Only the emotional factors in the creator's creativity did not emerge from the thematic analyses.

STONE CARVING AS CREATING

The interview shows that Benjamin Frantz's creative process is specific to him. However, his overall process is quite similar to those described by both artists and designers (Glăveanu et al., 2013), involving an idea–work–idea sequence. According to the view that he articulated in the interview, the initial idea corresponds to conception (the designer), the work to its realization (the artisan), and the second idea to post-production (the artist). Benjamin Frantz's initial conception step resembles the conception phase as described by artists (Mace & Ward, 2002) but with a difference: whereas artists speak of having more or less vague idea or impression, Benjamin Frantz has a precise concept that he then implements in a way that depends on situational constraints or his desires. In the end, his process is better described by Didier and Leuba's (2011) design–realization–socialization model. Didier and Leuba describe one loop for the creation of a work, which focuses on its function as a sign, and another loop for the creation of a product, whose main function lies in its utility. The designer sits at the intersection of the two (Didier & Bonnardel, 2020). Benjamin Frantz's process does in fact involve conceiving an original product (designer), realizing a useful product (artisan), and communicating its esthetic value to others (artist).

Let us now look at each of the major phases in turn. In the *conception* phase, Benjamin Frantz begins with his core idea: stone-light concept. The next subphase, reflection, includes incubation, a key step in the creative process (Russ, 1993; Zhang, Zhang, Wu, Tan, & Luo, 2019). Incubation consists of the unconscious association of ideas (Martindale, 1981; Simonton, 1980; Smith & Dodds, 1999). Because it is unconscious, this step is very difficult to identify in discourse, which expresses the creator's conscious awareness. Incubation can thus only be guessed through discourse involving words such as "trial and error" and

"uncertainties." Insight is the sudden and unexpected emergence of an idea (Sternberg & Davidson, 1999). This step has long been a matter of scholarly debate. Some authors argue that such sudden and unexpected leaps happen but are very uncommon, and that most ideas emerge gradually (Gruber & Davis, 1988; Weisberg, 1988). Benjamin Frantz's discourse speaks to both sides of this debate. He mentioned how insight could come through the association of ideas from one to the next (gradual emergence) or by chance (sudden emergence). This description is in line with the idea of the "prepared mind": being in the state of exploration, and ready to identify, accept and use the unexpected, and refers to the concept of serendipity (for more detail, see Ross & Copeland, 2022). And the final substep in conception consists in planning the work that is to follow. Here, this is similar to Howard et al.'s (2008) synthesis and analysis, wherein the expected behavior is given structure as a solution, and the solution is adjusted. In addition to the time required for conception, the involvement of emotional factors such as energy and excitement is also worthy of note.

When describing the *realization* (or making) phase, Benjamin Frantz explained that he always begins with test productions to make sure that his project is feasible. But could it be that these tests are due to his lack of experience, and more seasoned stone carvers with a stronger sense of how the stone will react may not need them? We may hypothesize that while more experienced stone carvers probably have less need for tests, the high level of precision required and the minimal margin for error probably leads most, even those with considerable experience, to carry out some (if possibly fewer) tests. Given Benjamin Frantz's drive toward discovery and the novel, it is likely that he will always perform such tests. The opposite would mean that the effects of his work were known and foreseeable, and he would thus lose interest in them. If, in the course of realization, Benjamin Frantz comes to feel that the project does not correspond to what he had planned, then he may modify either the concept or the ongoing realization. This step bears some resemblance to the three reformulations that Howard et al. (2008) suggest design students may choose if their design leads to an unsatisfactory behavior: changing the object's structure, its behavior, or its function. In the case of stone carving, it is noteworthy that realization is stressful and "a pain" due to the characteristics of both stone (costly) and the carving process (lengthy). It is interesting to note that despite the fact that the interview guide contains 2 specific questions on the place of emotions in the creative process, stress and "being a pain" are the very few expressions of emotion that appear in the discourse.

In *postproduction*, the carver checks the production, decides to stop work on it, and sets out to present and promote it socially. It is interesting to note that after a highly cognitive step (conception) and a highly manual step (realization), the process ends on the basis of emotions. Benjamin Frantz indicated that he stops when he is satisfied with the result and it matches his expectations—or he is fed up. Once again, emotional expressions are rare. Indeed, when Benjamin Frantz was interviewed about the place of emotions in his creative process, his answer was very concise ("I will start with the end, satisfaction, contentment, pride"). Moreover, this step seems to correspond both to the second idea in the idea–work–idea sequence (Glăveanu et al., 2013) and to socialization (Didier & Leuba, 2011). It involves reconsidering the message of the production after it is completed.

This second cluster also includes talk about the *resources* needed for creativity. It reflects the importance of the creator's physical, physiological, social, and material environment. These resources are among the environmental factors identified in the multivariate approach to creativity (Lubart et al., 2015). All three content analysis programs highlighted the importance of social resources. Benjamin Frantz explained that "discussing" or "talking" with others is a very effective way to reflect on his project. Note, however, that for realization itself, he finds the absence of social distractions essential ("I like to work at night, or rather I like to work when there's nobody around, when there are no possible distractions"). The differentiated role of social support at different stages of creation position, and so, these resources position Frantz's work in a sociocultural context (Glăveanu, 2015). The creator acts on the object, which itself interacts with the public and the environment. The creator is thus not an isolated individual, and his productions are the result of interactions with his social and material environment.

CREATIONS IN STONE CARVING

The final cluster, creations, is a particularly descriptive one. It consists of Benjamin Frantz's descriptions of his creations, techniques, and tools. Here we can see the importance of the manual character of the stone carver's activity. This cluster also includes all the constraints linked to working in stone. As we saw above, constraints are inherent to the definition of creativity (Lubart et al., 2015; Runco & Jaeger, 2012), and they favor it (Haught-Tromp, 2017; Moreau & Dahl, 2005; Stokes, 2005). The designer's process consists precisely

in managing these constraints (Howard et al., 2008). The main specificity of stone carving with respect to other forms of art is that the constraints of the form are much more present throughout the whole process.

It is important to note that the constraints are interlinked. The constraints of the stone-light concept condition the cost of the stone, which conditions the desire to maximize the size of the block and minimize losses; working with costly and delicate material allows a minimal margin for error, leading to a need for time and patience, as well as the need to be able to take carefully measured risks and to know when to stop before breakage occurs. This strongly echoes with the motivational danger described by Sennett (2008): "the obsession with getting things perfectly right may deform the work itself" (p. 11). But since breakage usually means total destruction, the balance to find between perfection and failure arouses such stress that it is treated as a strong constraint, or more precisely a growing constraint since it becomes more and more critical as the project advances, and hence the more to lose there is. At this stage, it is important to recall that different constraints have different statuses. Some are obligatory, some merely guide the work, and some are flexible (Vessey et al., 1992). The status and weight given to each depend on the creator (Bonnardel, 2006), but the nature of the craft may have a strong impact.

FURTHER RESEARCH AND LIMITATIONS

This study has brought together interacting contributions from three different analyses, allowing us to triangulate the data and deepen our understanding of the creative process. By combining a qualitative analysis (NVivo) with semi-automatic (Tropes) and automatic (IRaMuTeq) lexicometric analyses, we were able to analyze the creator's discourse down to a fine level of detail. Automatic analysis with IRaMuTeq identified three main thematic clusters, while the two other content analysis tools allowed us to specify details within each cluster. For example, one limitation is that Benjamin Frantz emphasized the cognitive and conative factors of his creative process, but despite specific questions, he provided few details about the emotional factors. While this in-depth case study has allowed us to better understand the stone carver's creative activity and process, it remains a case study, and the generalizability of the results is thus limited. Nonetheless, the classification that emerged is in line with the existing theoretical and empirical literature and may be reused for further qualitative studies in different creative domains. In future studies, it would be interesting to consider the characteristics of individual creators, such as their previous training and level of expertise, in order to better capture those factors' mediating role in the creative process.

This study also raises the question of how creativity, "potential originality and effectiveness" (Corazza, 2016, p. 262), is defined across fields. Indeed, according to Benjamin Frantz's definition, the artist creates esthetic but not necessarily useful objects, the designer conceives useful objects by responding to the constraints of the situation but does not necessarily produce them, and the artisan produces a useful object without having conceived it. Here, he does not make the distinction between originality and adaptation but between conception/realization of the object and its meaning (esthetic/useful). At this point, it is important to remember that this is a case study and consequently the point of view of a single participant. It therefore seems delicate to us to question the consensual definition of creativity, but perhaps, there is in this proposal, an opportunity to explore in future research in order to converge toward a definition of the characteristics of creativity common to all fields.

CONCLUSION

Through this interview, we sought to understand stone carving and the associated creative process, and to situate it in relation to two major creative domains, art, and design. A threefold content analysis highlighted the polymorphous character of this stone carver and his creative activity, which sits at the intersection of design, craft, and, to a lesser extent, art. This combination is due to the desire to create a product in Deforge's (1990) sense: that is, an object that, while it may be original and esthetic, is aimed above all at being useful. The complex positioning of stone carving shows that creative domains are not totally independent of one another, and deserve to be explored in relationship to one another.

FUNDING INFORMATION

The research was not funded.

CONFLICT OF INTEREST

The authors report there are no competing interests to declare.

DATA AVAILABILITY STATEMENT

Data can be asked to the third author.

REFERENCES

Baer, J. (1998). The case for domain specificity of creativity. *Creativity Research Journal*, *11*, 173–177; doi: 10.1207/s15326934crj1102_7.

Baer, J. (1999). Domains of creativity. In M.A. Runco & S.R. Pritzker (Eds.), *Encyclopedia of creativity* (vol. 1, pp. 591–596). New York: Academic Press.

Baer, J. (2010). Is creativity domain specific? In J.C. Kaufman & R.J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 321–341). Cambridge, UK: Cambridge University Press; doi: 10.1017/CBO9780511763205.021.

Baer, M. (2012). Putting creativity to work: The implementation of creative ideas in organizations. *Academy of Management Journal*, *55*, 1102–1119; doi: 10.5465/amj.2009.0470.

Blanchet, A., & Gotman, A. (2007). *L'enquête et ses méthodes: L'entretien* (2éd. refondue). Paris: Nathan Armand Colin.

Bonnardel, N. (1989). *L'évaluation de solutions dans la résolution de problèmes de conception*. Rapport de recherche RR-1072. Rocquencourt, France: INRIA.

Bonnardel, N. (2006). *Créativité et conception: Approches cognitives et ergonomiques*. Marseille, France: Solal.

Botella, M., Glăveanu, V.P., Zenasni, F., Storme, M., Myszkowski, N., Wolff, M., & Lubart, T. (2013). How artists create: Creative process and multivariate factors. *Learning and Individual Differences*, *26*, 161–170; doi: 10.1016/j.lindif.2013.02.008.

Botella, M., & Lubart, T. (2015). Creative processes: Art, design and science. In S. Agnoli & G.E. Corazza (Eds.), *Multidisciplinary contributions to the science of creative thinking* (pp. 53–65). Singapore City, Singapore: Springer.

Carmeli, A., McKay, A.S., & Kaufman, J.C. (2014). Emotional intelligence and creativity: The mediating role of generosity and vigor. *The Journal of Creative Behavior*, *48*, 290–309; doi: 10.1002/jocb.53.

Constantine, B.J. (2012). Exploring stone sculpture: A behavioral analysis. *European Journal of Behavior Analysis*, *13*, 141–148; doi: 10.1080/15021149.2012.11434414.

Corazza, G.E. (2016). Potential originality and effectiveness: The dynamic definition of creativity. *Creativity Research Journal*, *28*, 258–267; doi: 10.1080/10400419.2016.1195627.

Cornwall, A., & Jewkes, R. (1995). What is participatory research? *Social Science and Medicine*, *41*, 1667–1676; doi: 10.1016/0277-9536(95)00127-S.

Creswell, J.W., & Clark, V.L.P. (2017). *Designing and conducting mixed methods research*. Thousand Oaks: Sage.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, *11*, 1–9; doi: 10.1186/1471-2288-11-100.

Daniel, R. (2020). The creative process explored: Artists' views and reflections. *Creative Industries Journal*, *15*, 3–16; doi: 10.1080/17510694.2020.1755772.

Deforge, Y. (1990). *L'œuvre et le produit*. Seyssel, France: Champ Vallon.

Delefosse, M.S., Bruchez, C., Gavin, A., & Stephen, S.L. (2015). Diversity of the quality criteria in qualitative research in the health sciences: Lessons from a lexicometric analysis composed of 133 guidelines. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, *16*(2). https://doi.org/10.17169/fqs-16.2.2275

Didier, J. (2017). De la démarche anthropologique à la posture d'auteur en didactique. In G. Giacco, J. Didier, & F. Spampinato (Eds.), *Didactique de la création artistique: Approches et perspectives de recherche* (pp. 91–104). Louvain, Belgium: EME.

Didier, J. (2018). Technical culture and innovation culture: Reconciling through design. *Science, Technology and Innovation Culture*, *3*, 117–137; doi: 10.1002/9781119549666.ch7.

Didier, J., & Bonnardel, N. (2020). L'activité de conception et sa didactisation. In J. Didier & N. Bonnardel (Eds.), *Didactique de la conception* (pp. 13–29). Vaud, Switzerland: UTBM.

Didier, J., & Leuba, D. (2011). La conception d'un objet: Un acte créatif. *Prismes: Revue Pédagogique HEP Vaud*, *15*, 32–33.

Dul, J., & Ceylan, C. (2011). Work environments for employee creativity. *Ergonomics*, *54*, 12–20; doi: 10.1080/00140139.2010.542833.

Eisenhardt, K.M., & Graebner, M.E. (1989). Theory building from case study research. *Academy of Management Review*, *14*, 532–550; doi: 10.5465/amr.1989.4308385.

Feist, G.J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review*, *2*, 290–309; doi: 10.1207/s15327957pspr0204_5.

Fielding, N.G. (2012). Triangulation and mixed methods designs: Data integration with new research technologies. *Journal of Mixed Methods Research*, *6*, 124–136; doi: 10.1177/1558689812437101.

Flanagan, J.C. (1954). The critical incident technique. *Psychological Bulletin*, *51*, 327–358; doi: 10.1037/h0061470.

Flick, U., Garms-Homolová, V., Herrmann, W.J., Kuck, J., & Röhnsch, G. (2012). "I Can't Prescribe Something Just Because Someone Asks for It. . ." Using mixed methods in the framework of triangulation. *Journal of Mixed Methods Research*, *6*, 97–110; doi: 10.1177/1558689812437183.

Furnham, A., & Bachtiar, V. (2008). Personality and intelligence as predictors of creativity. *Personality and Individual Differences*, *45*, 613–617; doi: 10.1016/j.paid.2008.06.023.

Ghiglione, R., & Blanchet, A. (1991). *Analyse de contenu et contenus d'analyses*. Paris: Dunod.

Ghiglione, R., Kekenbosch, C., & Landre, A. (1995). *L'analyse cognitivo-discursive [The cognitive discursive analysis]*. Grenoble, France: Presses Universitaires de Grenoble.

Glaser, B.G., & Strauss, A.L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Routledge.

Glăveanu, V.P. (2015). Creativity as a sociocultural act. *The Journal of Creative Behavior*, *49*, 165–180; doi: 10.1002/jocb.94.

Glăveanu, V.P., Lubart, T., Bonnardel, N., Botella, M., De Biasi, P.-M., De Sainte Catherine, M., … & Zenasni, F. (2013). Creativity as action: Findings from five creative domains. *Frontiers in Psychology*, *4*, 1–14; doi: 10.3389/fpsyg.2013.00176.

Gruber, H.E., & Davis, S.N. (1988). Inching our way up Mount Olympus: The evolving systems approach to creative thinking. In R.J. Sternberg (Ed.), *The nature of creativity*, p. 243–270. Cambridge, MA: Cambridge University Press.

Guastello, S.J., Guastello, D.D., & Hanson, C.A. (2004). Creativity, mood disorders and emotional intelligence. *Journal of Creative Behavior*, *38*, 260–281; doi: 10.1002/j.2162-6057.2004.tb01244.x.

Haught-Tromp, C. (2017). The Green Eggs and Ham hypothesis: How constraints facilitate creativity. *Psychology of Aesthetics, Creativity, and the Arts*, *11*, 10–17; doi: 10.1037/aca0000061.

Howard, T.J., Culley, S.J., & Dekoninck, E. (2008). Describing the creative design process by the integration of engineering design and cognitive psychology literature. *Design Studies*, *29*, 160–180; doi: 10.1016/j.destud.2008.01.001.

Kalampalikis, N. (2003). Un laboratoire sans murs: le LEPS [A laboratory without walls: LEPS]. *Le Journal des psychologues*, 50–54.

Le Breton, D. (2004). *L'interactionnisme symbolique*. Paris: Puf.

Lefebvre, L., Reader, S.M., & Sol, D. (2013). Innovating innovation rate and its relationship with brains, ecology and general intelligence. *Brain, Behavior and Evolution*, *81*, 143–145; doi: 10.1159/000348485.

Lubart, T.I. (1999). Componential Models. In M.A. Runco & S.R. Pritzker (Eds.), *Encyclopaedia of creativity* (Vol. *1*, pp. 295–300). New York: Academic Press.

Lubart, T. (2017). The 7 C's of creativity. *The Journal of Creative Behavior*, *51*, 293–296; doi: 10.1002/jocb.190.

Lubart, T.I. (2000–2001). Models of the creative process: Past, present and future. *Creativity Research Journal*, *13*, 295–308; doi: 10.1207/S15326934CRJ1334_07.

Lubart, T.I., Mouchiroud, C., Tordjman, S., & Zenasni, F. (2015). *Psychologie de la créativité* (2nd edn). Paris: Armand Collin.

Mace, M.-A., & Ward, T. (2002). Modeling the creative process: A grounded theory analysis of creativity in the domain of art making. *Creativity Research Journal*, *14*, 179–192; doi: 10.1207/S15326934CRJ1402_5.

Martindale, C. (1981). *Cognition and consciousness*. Homewood, IL: Dorsey.

Miller, W.R. (2004). *Definition of design*. Redlands, CA: Environmental Systems Research Institute.

Moreau, C.P., & Dahl, D.W. (2005). Designing the solution: The impact of constraints on consumers' creativity. *Journal of Consumer Research*, *32*, 13–22; doi: 10.1086/429597.

Nakamura, J., & Csikszentmihalyi, M. (2003). The motivational sources of creativity as viewed from the paradigm of positive psychology. In L.G. Aspinwall & U.M. Staudinger (Eds.), *A psychology of human strengths: Fundamental questions and future directions for a positive psychology* (pp. 257–269). Washington, DC: American Psychological Association.

Paulus, P.B., & Nijstad, B.A. (2003). *Group creativity: Innovation through collaboration*. New York: Oxford University Press.

Pye, D. (1968). *The nature and art of workmanship*. Cambridge, UK: Cambridge University Press.

QSR International Pty Ltd. (2020). NVivo (released in March 2020). Available from: https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home [last accessed 1 May 2021].

Ratinaud, P. (2009). IRaMuTeQ: Interface de R pour les analyses multidimensionnelles de textes et de questionnaires [R interface for multidimensional text and questionnaire analysis]. Available from: http://www.iramuteq.org.

Reinert, A. (1983). Une méthode de classification descendante hiérarchique: Application à l'analyse lexicale par contexte [A hierarchical top-down classification method: Application to context-based lexical analysis]. *Cahiers de l'Analyse des Données*, *8*, 187–198.

Rockwell, P. (1990). Stone-carving tools: A stone-carver's view. *Journal of Roman Archaeology*, *3*, 351–357; doi: 10.1017/S1047759400011193.

Ross, W., & Copeland, S. (Eds.). (2022). *The art of serendipity*. Switzerland: Palgrave Macmillan.

Runco, M.A., & Jaeger, G.J. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*, 92–96; doi: 10.1080/10400419.2012.650092.

Russ, S.W. (1993). *Affect and creativity: The role of affect and play in the creative process*. Hillsdale, NJ: Lawrence Erlbaum.

Sánchez-Ruiz, M.J., Hernández-Torrano, D., Pérez-González, J.C., Batey, M., & Petrides, K.V. (2011). The relationship between trait emotional intelligence and creativity across subject domains. *Motivation and Emotion*, *35*, 461–473; doi: 10.1007/s11031-011-9227-8.

Schlewitt-Haynes, L.D., Earthman, M.S., & Burns, B. (2002). Seeing the world differently: An analysis of descriptions of visual experiences provided by visual artists and nonartists. *Creativity Research Journal*, *14*, 361–372; doi: 10.1207/S15326934CRJ1434_7.

Sennett, R. (2008). *The craftsman*. New Haven & London: Yale University Press.

Simonton, D.K. (1980). Intuition and analysis: A predictive and explanatory model. *Genetic Psychology Monographs*, *102*, 3–60.

Smith, S.M., & Dodds, R.A. (1999). Incubation. In M.A. Runco & S.R. Pritzker (Eds.), *Encyclopaedia of creativity* (vol. 2, pp. 39–43). New York: Academic Press.

Soldz, S., & Vaillant, G.E. (1999). The Big Five personality traits and the life course: A 45-year longitudinal study. *Journal of Research in Personality*, *33*, 208–232; doi: 10.1006/jrpe.1999.2243.

Stanko-Kaczmarek, M. (2012). The effect of intrinsic motivation on the affect and evaluation of the creative process among fine arts students. *Creativity Research Journal*, *24*, 304–310; doi: 10.1080/10400419.2012.730003.

Stecker, R. (2005). Definition of art. In J. Levinson (Ed.), *Oxford handbook of aesthetics* (pp. 136–154). Oxford: Oxford University Press; doi: 10.1093/oxfordhb/9780199279456.003.0007.

Sternberg, R.J., & Davidson, J.E. (1999). Insight. In M.A. Runco & S.R. Pritzker (Eds.), *Encyclopaedia of creativity* (vol. 2, pp. 57–69). New York: Academic Press.

Sternberg, R.J., & Lubart, T.I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. New York: Free Press.

Sternberg, R.J., & O'Hara, L.A. (2000). Intelligence and creativity. In R.J. Sternberg (Ed.), *Handbook of intelligence* (pp. 252–272). New York: Cambridge University Press.

Stokes, P.D. (2005). *Creativity from constraints: The psychology of breakthrough*. New York: Springer.

Storme, M., Myszkowski, N., Çelik, P., & Lubart, T. (2014). Learning to judge creativity: The underlying mechanisms in creativity training for non-expert judges. *Learning and Individual Differences*, *32*, 19–25; doi: 10.1016/j.lindif.2014.03.002.

Vessey, I., Jarvenpaa, S.L., & Tractinsky, N. (1992). Evaluation of vendor products: CASE tools as methodology companions. *Communications of the ACM*, *35*, 90–105.

Weisberg, R.W. (1988). Problem solving and creativity. In R.J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 148–176). Cambridge, UK: Cambridge University Press.

Wolfradt, U., & Pretz, J.E. (2001). Individual differences in creativity: Personality, story writing, and hobbies. *European Journal of Personality*, *15*, 297–310; doi: 10.1002/per.409.

Zenasni, F., Besançon, M., & Lubart, T. (2008). Creativity and tolerance of ambiguity: An empirical study. *The Journal of Creative Behavior*, *42*(1), 61–73. https://doi.org/10.1002/j.2162-6057.2008.tb01080.x.

Zenasni, F., & Lubart, T.I. (2001). Adaptation française d'une épreuve de tolérance à l'ambiguïté: Le M.A.T. *European Review of Applied Psychology/Revue Européenne de Psychologie Appliquée*, *51*, 3–12.

Zenasni, F., & Lubart, T.I. (2008). Emotion related-traits moderate the impact of emotional state on creative potential. *Journal of Individual Differences*, *29*, 157–167; doi: 10.1027/1614-0001.29.3.157.

Zhang, Z., Zhang, W., Wu, X., Tan, T., & Luo, J. (2019). Incubation optimizes the promoting effects of rewards on creativity. *PsyCh Journal*, *8*, 271–272; doi: 10.1002/pchj.251.

Marion Botella, Université Paris Cité, Université Gustave Eiffel

Léonore Robieux, Université Paris 8

Benjamin Frantz, Université Paris Cité, Université Gustave Eiffel

Correspondence concerning this article should be addressed to Marion Botella, Université Paris Cité, Laboratoire de Psychologie et Ergonomie Appliquées (LaPEA), 71 avenue Edouard Vaillant, F-92100 Boulogne Billancourt, France. E-mail: marion.botella@u-paris.fr

AUTHOR NOTE

We would like to thank John Abi Hana, Flore Vindry, Chloë Onisoamiaranarivo, and Florence Picon-Whitehurst, for their help with the coding.