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Relations in aesthetic space

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Relations in Aesthetic Space:
How Color Enables Market Positioning

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Abstract

Color is omnipresent, but organizational research features no systematic theory or established method for analyzing it. We develop a relational approach to color, conceptualizing it as a means of positioning relative to a reference group or style and validating it through a computational method for processing digital images. The research context is Norwegian black metal—a genre of extreme metal music that achieved notoriety in the early 1990s through band members' criminal activity. Our analysis of 5,125 album covers between 1989 and 2019 confirms the alignment of aesthetic and music features and articulates the role of color in the construction of a relational identity based on forces of association and disassociation. Black metal bands associated with past color choices of non-black metal bands up to a point, after which they started to disassociate from them. The positioning is dynamic, pursuing adaptation to external events. Black metal bands reacted to their stigmatization in Norwegian society by increasing colorfulness and later returning to a darker aesthetic in defiance of the genre's commercialization. Our analysis attests to color's ability to organize producers' exchange of information and attention, illustrating the interweaving of aesthetic features and relational processes in markets.

Keywords: aesthetics, color, market positioning, relational identity, black metal, computational methods

Ingmar Bergman's masterpiece film *The Seventh Seal* (1957) has become etched into collective memory through the personification of death as a black-clad, menacing figure, playing chess with a knight who undergoes a crisis of religious faith. The cinematography achieves a resonant aesthetic impact by juxtaposing dark and light colors; black and white pieces on the chessboard embody the dualistic dynamic between life and death, good and evil. Color in this context is a valuable tool, allowing the artist to invoke symbolic meaning and amplify its emotional resonance.

Color looms large in all walks of life, not only in filmmaking. Individuals and organizations make everyday decisions about the palette or intensity of colors to feature in clothes or products. The choice between bright and muted colors signals aspects of our identity (Rose-Greenland, 2016). The "self-consciously restrained use of color" has served for centuries as an instrument of social distinction in Europe (Taussig, 2009: 24): colors too rich or showy tend to be perceived as unbecoming of those who must present a dignified appearance, as manifest in corporate culture (Pastoureau, 2008). Yet this perception contrasts with the fondness for color that existed in ancient Rome and Renaissance Italy, epitomized in artworks and decorations (Rose-Greenland, 2016).

Scholars recognize that color is a central feature of social life (Rose-Greenland, 2016) and that its application is socially patterned, reflecting fundamental collective processes and emotions (Turner, 1990). It is therefore surprising that color remains muted as a research subject, as evidenced in the absence of a systematic theory of color in sociology (Fine et al., 1998), psychology (Elliot and Maier, 2007), and organizational scholarship (Beyes, 2017; Formilan, 2021). There are several reasons for this. The most important is scholars' skepticism regarding the appropriateness of sensory stimulation and optical phenomena as topics of social analysis, as they consider vision and the brain more suited to the natural sciences (Onians, 2007). Second, color is rarely treated as a self-sufficient unit and is often

subsumed under "stylistic" and "aesthetic" categories (e.g., Strati, 1990, 2000). Third, color seems to evade attempts to codify it systematically (Riley, 1995). There is no established quantitative methodology in a field that is dominated by experimental work that provides relatively ambiguous and inconclusive evidence (Labrecque, Patrick, and Milne, 2013).

To surmount these obstacles, we develop a relational approach to the analysis of color and validate it with an original methodology that allows us to extract information from digital visual sources. We assume that color obtains meaning from its association with actors and objects (Fine et al., 1998). We treat it as an element (Swidler, 2001) or a choice with social value (Rose-Greenland, 2016) derived from two types of relations: to other elements that make up a style and to reference groups. In this perspective, color constitutes a means of positioning relative to a group or a set of elements. This positioning is inherently dynamic: the meaning attributed to a color is contingent on comparison to colors dominating a given context at a point in time (Fine et al., 1998; Formilan, 2021).

What differentiates this approach from established approaches to aesthetics anchored in psychological, phenomenological, or semiotic research (e.g., Strati, 1990, 2000; Elsbach, 2009; Elsbach and Flynn, 2013) is its relational nature. Comprehensive recent reviews of the literatures on the visual dimension in organizational scholarship (Meyer et al., 2013) and organizational aesthetics (Baldessarelli, Stigliani, and Elsbach, 2021) attest to the diversity and exuberance of this emerging subfield, but these reviews attribute little theoretical weight to the relational dimension. We bring out this dimension by drawing on relational sociology (e.g., White, 1992; Emirbayer, 1997) and on key tenets of the sociologies of Simmel (1957) and Tarde (1897). Redirecting attention from practices of sensemaking (Elsbach, 2009; Meyer et al., 2013) to those of positioning, we propose a framework in which the use of color contributes to the affirmation of relational identities and is animated by forces of association and disassociation (Simmel, 1957), imitation and differentiation (Tarde, 1897).

Our research context is Norwegian black metal—a genre of extreme metal music that gained notoriety in the early 1990s when band members set on fire historic wooden churches in Norway. As a rare music genre that defines itself through a color, black metal provides a unique opportunity to explore the ways in which color allows bands to position an emerging genre over time. Our analysis of the color palettes of album covers over three decades demonstrates alignment between color and content as well as the use of color in a positioning dynamic of simultaneous association with and disassociation from a reference group. In this context, color facilitated adaptation to events as bands responded to stigmatization in Norwegian society by reducing blackness, in pursuit of normalization, and then returned to the traditional aesthetic of dark colors, to articulate resistance to the genre's commercialization.

The objective of our analysis is to enhance the theoretical and empirical value of color by embedding it in a combination of endogenous and exogeneous social processes. The contribution is both theoretical and methodological, as we conceptualize and document the organizing force of color (Beyes, 2017): the ways in which it organizes the flow of information and exchange of attention between producers. The results attest that color choices are valuable sources of information on the dynamics of market positioning and the construction of identities. Scholars recognize that markets are structured by contrasting identities of producers (White, 1992); what is not as well understood is how the contrast of colors both embodies these identities and helps them emerge.

A Relational Theory of Color

Since the 1980s, scholarly interest in elements and practices relating to the sensuous and aesthetic domains has grown (Strati, 1990, 2000; Turner, 1990; Cattani et al., 2020). This interest encompasses both sensory reactions to aesthetic objects and their cultural meanings

(Creed, Taylor, and Hudson, 2020), covering various practices that use line, form, color, or texture to elicit an emotional reaction (Bloch, 1995). Organizations rely increasingly on visual tools and expressions (i.e. images, logos, or videos) to create and convey identities, organize their activities, and compete in the marketplace (Boxenbaum et al., 2018; Cattani et al., 2020). This has contributed to a "visual" turn in scholarship that documents how meaning is created, communicated, and stored through visual means (e.g., Meyer et al., 2013; Bell, Warren, and Schroeder, 2014; Boxenbaum et al., 2018).

But this resurgence of interest in the visual domain has strangely lacked color (Beyes and De Cock, 2017). This appears less strange when we consider that even in fields in which we might expect specialized studies of color, such as the history of art, color has long remained conspicuously absent (Pastoureau, 2008: 178). This absence may be largely due to color's ambivalence: it is simultaneously an objective physical property (the effect of reflected wavelengths of light) and a subjective experience as a perception dependent on our eyes as receivers (Baxandall, 1985; Suler and Zakia, 2018). Color is simultaneously a hue, form, and pigment characterized by objective physical traits, such as brightness and saturation. These traits shape the perception of color, but its meaning and intensity are always relative to other colors. Our perception of a color results from its interaction or contrast with other colors (Albers, 2013), leading to designations of color as a "chameleon" (Suler and Zakia, 2018: 158). It depends not only on light and an observer but also on its surroundings, as no color is independent of its neighbor.

The chameleonic nature of color is also due to its subjective experience. Color has affective force and is associated with emotional states (Beyes and De Cock, 2017). Scholars have recognized that the use of color manifests individual or collective emotions (Turner, 1990) and psychological components of the self (Fine et al., 1998; Elsbach, 2009). Color organizes feelings according to specific (social) connotations, such as when product designers

manipulate color to create a sense of personality for brands (DeLong and Goncu-Berk, 2012) and invoke an emotional state conducive to purchase (Suler and Zakia, 2018). Color moderates the association between what people observe and their memories and feelings (Meyers-Levy and Zhu, 2010).

But color does more than just materialize internal emotional states—it is a social technology and an organizing tool that accomplishes social work as a medium of relationships between subject and object (Beyes, 2017). The culturally encoded ways of seeing, evaluating, and communicating color (Creed, Taylor, and Hudson, 2020) are embedded in relations to places, ideas, categories, and people (Kress and Van Leeuwen, 2002). Color is not just relative but relational, embodying interpersonal dynamics. For Goethe (1840[1810]), color constitutes a relational force, ever in movement between subject and object. As Kress and Van Leeuwen (2002: 349) observed, it is not just that color "expresses" or "means" but that people use color to act on others and to present themselves and the values they stand for in the context of specific social situations.

The notion that color choice is relational is the starting point in a framework that conceives of color as a social element subject to basic modalities of interaction (Tarde, 1897). Drawing inspiration from the relational tradition in cultural sociology (e.g., Bielby and Bielby, 1994; Swidler, 2001), we postulate that the meaning of color emerges from relations with objects, persons, or events (Formilan, 2021), highlighting its ability to externalize identities and to connect relevant others into a network. Similar to Godart and Galunic (2019), we articulate two types of relations: between cultural producers and elements and between the elements themselves. We designate as "internal" the relations between color and other stylistic elements specific to a producer and as "external" those that connect producers based on their color choices. We assume that elements compete for attention (Lena and Peterson, 2008) and are connected through producers who adopt them (Breiger, 1974), and

that the two types of relations contribute to a color-based relational identity combining relations and elements.

Color is not perceived in isolation; it represents an aspect of individual style. Style is a durable pattern of aesthetic choices (Godart, 2018: 106) that is multidimensional and combinatorial (Eckert, 2004). By assembling elements across contexts, style combines content and form (Goodman, 1978). It simultaneously represents an aggregation of aesthetic choices and their moderator, as it has a normative function in orienting lines of action (Gadamer, 1986). For example, the style of the punk subculture (Hebdige, 1979) includes elements such as hairstyle, language, musical tastes, and colors. A penchant for bright colors is aligned with the discordant music, foul language, and spiky hair. The relations between color and other elements influence the perception of each element so that color is perceived and valorized on the basis of its alignment with the whole. Producers and audiences take into account internal relations between form and content in making aesthetic decisions (Witkin, 1990), such as in the alignment between music played by DJs and their choices of color (Formilan, 2021).

The meaning attributed to color comes from its relation not only to other stylistic elements but also to reference groups, which allows color to be employed as a positioning device. The last two decades have witnessed renewed interest in endogenous accounts (see Kaufman, 2004) that analyze culture as an ecosystem of actors and elements whose internal dynamics produce the social mechanisms by which practices evolve (e.g., Lieberson, 2000). This framework assumes that producers make choices that position them in markets vis-à-vis reference groups of competitors and audiences (White, 1992; Godart and Galunic, 2019) and that the ecosystem has an inherent capacity for similarity before producers are motivated to differentiate themselves (Askin and Mauskapf, 2017).

Attention to dynamics of imitation and differentiation has a long history in sociology. For Simmel (1957, 1991), the driving forces of aesthetic choices are association with and disassociation from a group. Similarly, for Tarde (1897), social relations are the product of three forces: imitation, differentiation, and adaptation. Imitation of others generates practices of repetition, but repetition is conducive to differentiation through the aggregation of minuscule divergences. The interacting forces of imitation and differentiation generate arrangements of connected groups. Color partakes in this dynamic when it is overlaid on the arrangements and serves objectives of positioning. For example, the resplendent colors of the Impressionists made visible their differentiation from Academic art (Sgourev, 2021). When black became the vestimentary color of the Benedictine Order in the Middle Ages, other monastic orders chose white or brown in reaction to it (Pastoureau, 2008).

Actors are often embedded in complex networks composed of both positive and negative relations of proximity and distance (Simmel 1991[1908]). As a consequence, they may face contradictory pressures to use more or less color. Their choices are contingent on their identity and the prioritized reference groups. In relational sociology (e.g., White, 1992; Emirbayer, 1997; Tilly, 1998), identities are considered inherently relational (constituted in relation to each other), evolving from the mutual observation and interaction of producers in a market. For White (1992), identity denotes an arrangement of constraints that structures exchanges of information or resources within a network. Relational identities establish and control social relations (Fuhse, 2009), organizing them into a set of categories, roles, and groups. Color may act as an instrument of such control when it is implicated in the interplay between relations and identities and is used to assign membership to groups or maintain divisions between groups.

Fundamental in this process is the practice of contrast. Contrast in art describes how opposites (e.g., rough vs. smooth, light vs. dark colors) are arranged to create interesting

visual effects (Aloumi et al., 2013). But a contrast of colors is socially meaningful when it is overlaid on relational oppositions. For White (1992), meaning in social life is achieved through contrast, allowing relational identities to crystallize and gain social footing. Group identities are pegged to color (Rose-Greenland, 2016); a color can help a relational identity emerge when the color encodes membership in or opposition to a group. Thus the colorfulness of a counterculture contrasts with conventions associating refinement with muted colors (Taussig, 2009). Bright colors came to epitomize the avant-garde identity of the Ballets Russes through contrast with the preponderance of white in classical ballet (Sgourev, 2015).

The perception and dissemination of colors are contextual and temporal. If medieval images were very colorful, the invention of the printing press resulted in the centuries-long domination of black and white in the visualization of images (Pastoureau, 2008). A relational approach requires attention not only to the elements of an ecosystem but to how these elements and the principles that connect them change over time. The role of color may shift from being decorative to occupying center stage (and vice versa). Similarly, our cognitive equipment for understanding color changes over time, for example precluding observations that may have appeared natural in the fifteenth century (Baxandall, 1985).

Aesthetic perception depends on constructs such as status, identity, or career stage that vary over time (Becker, 1982; Sgourev and Althuizen, 2014). Colors have a "traceable lifespan" in terms of their material mortality and the social process of making things colorful and maintaining them as such (Rose-Greenland, 2016: 82). Both the degree of alignment between color and content and the choice of reference groups vary over time, as the use of color adapts to changing tastes or new trends by pursuing proximity to or distance from them. Constant disruption undermines stability; practices mutate by adapting to others' efforts to imitate or differentiate (Tarde, 1897).

At the same time, the use of color is embedded in cultural archetypes with staying power (Fine et al., 1998). The color black is a classic example: beginning in the eleventh century in Western Europe, it became the diabolical color par excellence as the color of night and darkness, Satan, sin, and death (Pastoureau, 2008). The conception of black as repudiation of light and colorfulness (Sherman and Clore, 2009) is an archetype in aesthetics.[1] The repudiation has moral connotations, illustrated in the black-and-white contrast between light and shadow, good and evil (Zarkadi and Schnall, 2013). Sherman and Clore (2009: 1024) showed that people associate blackness with immorality and impurity quickly and relatively automatically, concluding that "Sin is not just dirty, it is black. And moral virtue is not just clean, but also white."

Temporal or contextual factors always moderate the enduring, archetypal aspects of color conventions. The symbolic meaning of color can be contextually adapted to enable divisions. Goethe (1840[1810]) observed that in the early nineteenth century, people of refinement in northern Europe had a disinclination to colors, with women wearing white and men black. In this context, black embodied the entrenched Protestant penchant for somber colors (Pastoureau, 2008) and rejection of bright colors associated with popular taste (Adorno, 1997), but it was also used to differentiate gender categories of the upper classes, based on associations of purity. In the sixteenth century, the visual austerity of newly emerging Protestantism provoked a chromophilic Catholic reaction and indirectly contributed to the colorful splendor of Baroque art (Pastoureau, 2008: 128). The color black thus appears paradoxical, as it may be used to designate both what is marginal and what is established, to signify both refinement of a dominant social group (Fine et al., 1998) and resistance to this domination by a lower-status group or a counterculture (Adorno, 1997).

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[1] White is associated with light because in physics, white is in fact white light (Connellan, 2013).

Duality also exists in the dynamic relations between actors and objects and between relational identities and colors. Actors may use color to fulfill multiple objectives: to assert normative conformity, achieve differentiation from competitors (Formilan, 2021), reinforce class distinction (Taussig, 2009), or signal authenticity, as captured in the expression "true colors" (Taussig, 2009: 18). Color orchestrates a play of expression and concealment (Menke, 2013), highlighting some aspects of identities and hiding others.

We postulate that choice of color expresses underlying oppositions that define relational identities but that color can reinforce or blunt these oppositions. Color has an agential force (Beyes and De Cock, 2017) as it "embodies and transforms social relations" at the same time (Eaton, 2012: 62). Gell (1998) differentiated "primary" agency, which relates to human action, from the "secondary" agency of things, which is identifiable in events initiated by humans. Secondary agency is "attributable to those persons and things who/which are seen as initiating causal sequences" (Gell, 1998: 16). Actors can use color as a positioning device, but we should not forget that it is the device that allows the positioning (e.g., Yaneva, 2009). The use of color reflects but also shapes social reality (Preston, Wright, and Young, 1996); a relational identity sustains color, but color can also help a new identity to emerge.

A good illustration is van Gogh's trademark color—his radiant, golden yellow. His use of the color was related to an emotional state, but the relationship was convoluted and could not explain the dramatic change from an earlier period dominated by dark, muddled colors.[2] This change was largely motivated by his relocation to France and proximity to the Impressionists, as bright colors signified affiliation with the ascending paradigm and distinction from Academic art (Sgourev, 2021). But none of the artists at the time painted

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[2] "The uglier, older, meaner, iller, poorer I get, the more I wish to take my revenge by doing brilliant color, well arranged, resplendent." van Gogh letter, Arles, about Sept. 14, 1888. Available at https://vangoghletters.org/vg/letters/let678/letter.html.

with colors nearly as bold; by escalating the intensity of color, van Gogh not only created his signature style (Elsbach, 2009) but reinforced the autonomous role of color in art. How color affirms and shapes identities is displayed in a visceral manner in the context of black metal. The next section elaborates these processes.

Norwegian Black Metal

Black metal emerged in Norway's underground heavy metal scene around 1990. It followed in the footsteps of early heavy metal bands (e.g., Black Sabbath) that explored the occult in their music and lyrics (Walser, 1993). The first wave of black metal took place outside Norway in the early 1980s, represented by the bands Venom (UK), Bathory (Sweden), and Mercyful Fate (Denmark). The second wave was pioneered by a few Norwegian bands (Mayhem, Burzum, Emperor, Darkthrone, and Immortal) that pushed metal toward harsher sound and imagery (Patterson, 2013).

As an expression of their opposition to what they viewed as the commercialization of heavy metal at the time, these bands adopted extreme images and lyrical themes that articulated pagan, anti-Christian messages. A taste for the macabre manifested in blasphemous lyrics, demonic stage personae, or the application of corpse paint on band members' faces (Phillipov, 2012). As an underground genre, black metal was characterized by musical experimentation and low record sales (Patterson, 2013: 310). Incomprehensible vocals, a heavily distorted guitar sound, and a dark façade made this genre difficult to consume and almost impenetrable to the casual listener (Walser, 1993).

Members of the Norwegian black metal scene went a step further in celebrating the forces of evil by committing a series of criminal acts (from 1991 to 1996), including church burnings, grave desecration, burglary, assault, and murder. Most conspicuous were the arson attacks on around 30 of Norway's historic wooden churches (Phillipov, 2012), leading to

prison sentences for the perpetrators and lasting notoriety for the genre. But surprisingly, black metal continued to attract fans and to grow worldwide, with tens of thousands of bands playing black metal (Patterson, 2013). The genre entered mainstream music with the success of bands such as Satyricon and Dimmu Borgir in the early 2000s. Bands started selling hundreds of thousands, even millions, of albums. In less than a decade, the genre grew from an obscure subculture to Norway's largest cultural export (Beste and Kugelberg, 2008), with a committed global fan base. The history of black metal in Norway can be divided into four periods: the underground years (1990–1993), the moral panic and stigmatization of black metal from 1994 to about 2000, the commercialization of the genre from the early 2000s until about 2008, and its current period.

Black metal is traditionally characterized by a strong oppositional stance to contemporary society and to organized religion (Aasdal and Ledang, 2008). Preoccupation with themes such as evil, darkness, death, or suicide is misaligned with dominant culture—a sign of rebellion against normality and the political system in Norway, which band members perceived as suffocating individuality (Moynihan and Søderlind, 1998). This rebellion sought to reassert a Viking past and the virtues of individualism, isolation, and connection to nature (Hoad and Whiting, 2017).

One of the most notable ways in which bands channeled this rebellion was through the color black, activating archetypical links between blackness, immorality, and resistance. These links were reinforced by a visceral dislike for whiteness as representing divinity, originating in its dual symbolic meaning (Connellan, 2013). The first meaning associates white with divine light; Catholicism has elevated white to a symbol of the soul untainted by sin. The second meaning derives from the institutional power of the Church: the ostensibly neutral color white is an agent of control, organizing silence and creating hierarchies (Connellan, 2013).

Black in this aesthetic space becomes a symbol of resistance—not only to the purity and controlling faculty of whiteness but also to popular culture's predilection for color. As Adorno (1997: 39–40) argued, the color black has a dual function: the negative function transpires in the repudiation of color and the reduction of expressive means as a rejection of "contemporary production [that] childishly delights in color." A positive function is also present: through its negativity, blackness differentiates itself from the merely affirmative that has little aesthetic value.

The color black became the defining expression of an oppositional attitude (Rydehed, 2009) and epistemological negativity (Silk, 2013), giving rise to a pared-down, somber aesthetic that represents the rejection of normality as a principle of belonging (see Sgourev and Aadland, 2022). Black metal emerged in reaction to death metal's insincere embrace of death, thereby reinforcing associations with the macabre. Naturally, this led to the rejection of bands that "look totally normal with these goddam jogging suits" (Euronymous in *Slayer Magazine* #8, Feb./March 1991) and whose normal, healthy, and colorful appearance made them look like "the hippies of the 90's" *(*Bård "Faust" Eithun of Thorns in *Daemonium Aeturnus Zine* #2, 1992).[3] This contrast is illustrated in Figure 1, which juxtaposes representative black metal album covers and band photos with those of non-black metal genres in the 1990s.[4]

[Insert Figure 1 About Here]

As an underground genre, black metal was not present on stages and at festivals; album covers were the primary means through which bands could project a visual identity in the market. The bands used dark colors to stake out a distinct position in aesthetic space, as a

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[3] This rejection culminated in the "Helvete" ("Hell") record store owned by Euronymous ("Mayhem"), which served as a meeting point in the early 1990s, exposing future band members to the music, lyrics, and aesthetics of other bands. It is considered the birthplace of black metal.

[4] For readers seeing this article in black and white, please refer to the Online Appendix for full-color images.

rejection of what was intended to please and sell. For the band Enslaved, "The ideal was the opposite. More toward German minimalism, black and white art. With the person more in the shadows and the music was in focus to create these large gothic soundscapes." Fenriz, from the band Darkthrone, recounts the making of their first black metal album: "The album had just a black and white cover. At the time everyone wanted colory, painted wimp stuff on the album covers. We went for a grimmer approach. In hindsight, you can say people noticed that."[5]

Fenriz also recounts the introduction of portrait covers, featuring a band member in a high-contrast, black-and-white photograph: "We wanted both the organic 1970s sound, but also to make it cold. And to make it cold, you can choose a black and white image, diffuse, of one of the band members on the album cover."[6] Revolutionary at first, this style was quickly adopted by other bands and became an aesthetic convention in black metal (Patterson, 2013: 198). This reflects two core features of the early black metal scene: mutual observation between bands and a do-it-yourself spirit. Even when some bands became commercially successful in the 2000s, they retained control over album covers, as attested by Satyr of Satyricon: *"In order to deliver that kind of art we do, I put my head together with some of the finest in photography and graphic design. Then I make sure that these people work with me and not for me. We focus and try to reflect what lies within the musical and lyrical content in the visual side of SATYRICON"* (*Slayer Magazine* #13, Jan. 2000). These statements on the aesthetics of black metal informed the development of our hypotheses, which we discuss next.

Hypotheses

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[5] The Enslaved interview is available here: https://www.youtube.com/watch?app=desktop&v=vHLKpiFVrSo, and the Fenriz interview can be found here: https://www.youtube.com/watch?app=desktop&v=-5E3gHlAJxA.
[6] Available at: https://www.youtube.com/watch?v=d858ZECeNCY.

Our principal expectation is that black metal bands employ black color in order to affirm their opposition to both popular culture (rich colors) and institutional religion (whiteness). The use of muted colors and black-and-white contrast should reflect this, capturing the opposition between negative and positive forces. We posit that color choices occur in reference to a group: black metal traditionally shaped itself in opposition to the commercially oriented heavy metal scene (Patterson, 2013: 313). Along the same lines, Kahn-Harris (2006: 59–66) discussed how early black metal distinguished itself from other forms of metal and from mainstream culture. In our framework, color choices on album covers are subject to two social forces: association and disassociation (Simmel, 1957), or imitation and differentiation (Tarde, 1897), from the reference group.

Studies of cultural industries document the complex forms of interaction between these forces, which manifest in producers' efforts to achieve legitimacy by reproducing conventions but also to gain recognition by differentiating in a highly competitive environment (e.g., Becker, 1982; Caves, 2000). The interaction between the two social forces assumes a curvilinear form when producers' initial pursuit of similarity creates incentives for the subsequent assertion of difference (e.g., Askin and Mauskapf, 2017). We expect to observe a similar pattern in our context. Black metal needs to first establish itself by way of association with the broader metal category. Paying attention to the content and style of relevant albums and maintaining association with certain sonic and aesthetic features of other bands would confirm that a band belongs in the metal universe.

However, bands also need to position themselves sufficiently apart from the reference group to merit attention in their own right. We expect that there is a limit to how far association with aesthetic choices can advance before it initiates momentum toward differentiation, such that black metal bands use muted colors and black-and-white contrast to project a more somber image than that of the reference group. Color (or its lack) assists in the

emergence or confirmation of a relational identity. Hypothesis 1 thus posits a curvilinear relationship whereby black metal bands follow prior color choices of non-black metal bands (on album covers) up to a point, after which they tend to disassociate from these choices.

> **Hypothesis 1 (H1):** Black metal bands associate with non-black metal bands' (album cover) choices on colorfulness and contrast up to a point, after which they start to disassociate from them.

Color not only embodies actors' association with or difference from their peers but also enables them to adapt to external events. The interaction of forces of imitation and differentiation determines the process of adaptation (Tarde, 1897). Cultural practices evolve through a combination of endogenous and exogenous factors (Isaac, 2009), such as producers' mutual observation (White, 1992) or exogeneous changes in classification systems (Lena and Peterson, 2008) and audience preferences (Becker, 1982). Accordingly, we assume that bands' color choices are influenced by choices of other bands considered relevant and by events affecting the degree of acceptance by Norwegian society or demand for the music. Two key events in the history of black metal are its stigmatization in the mid-1990s and its commercialization in the early 2000s, when strong international record sales encouraged the genre's acceptance in Norway.

The church-burning transgressions perpetrated by members of the black metal scene, and their indictment, led to a "moral panic" in Norwegian society (Kahn-Harris, 2006: 28). Widely perceived as a threat to society (Moynihan and Søderlind, 1998; Patterson, 2013), black metal in the mid-1990s faced "event" stigma (Hudson and Okhuysen, 2009) in Norway. As observed in an article about the band Emperor, "At least from the point of view of the majority of the Norwegian population, Black Metal is something to be feared in the same way as horror stories about football hooligans in the British press" (*Terrorizer Magazine*, May 1997). The stigma abated in subsequent years with the abandonment of criminal activity and growing international record sales, bringing a degree of respectability and recognition

(Sgourev and Aadland, 2022). As Mortiis, of Emperor, remarked, in the late 1990s black metal "was spreading across the world, lots of bands were popping up, it was too late to stop" (*Metal Hammer*, July 20, 2017). The strong sales and global diffusion contributed to the genre's growing acceptance, but vestiges of the stigma remain to this day (Patterson, 2013).

The defining function of the stigmatization process is exclusion of actors who may threaten a community through the spread of perceived social disorder (Goffman, 1963). Audiences inflict social and economic sanctions by limiting the opportunities and mobility of stigmatized actors (Sutton and Callahan, 1987; Devers et al., 2009). It is not surprising that local record companies, record stores, and established media channels blacklisted the emerging genre, refusing to treat it on equal terms with other genres.[7] Thus rock festivals were threatened with suspension of their municipal funding if they featured these bands.[8]

Stigmatization attracted attention to the new genre, confirming its transgressive nature and underground credentials. However, the sanctions associated with stigmatization posed an existential threat to a genre that had so far had only a few official album releases (Moynihan and Søderlind, 1998). We therefore expect black metal bands to respond to the threat of sanctions by increasing colorfulness and attenuating the confrontational, black-and-white contrast on their album covers. Past studies have shown that organizations use normalizing accounts to project an image that directly challenges audiences' negative evaluation (Elsbach, 2003; Hudson, 2008). Accordingly, we expect that bands use color as a normalizing tool to project a less threatening image of black metal than what the media presented or what had characterized the genre in its underground period, when the license to experiment in both

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[7] "No one in Norway—neither major record companies, most record stores or established media—has so far dared or wanted to treat so-called black metal on an equal footing with other music genres." ("Svart metal for massene?" *Verdens Gang*, Aug. 19, 1998)
[8] "It was supposed to be the black metal happening of the year, but now it may turn out to be the failure of the year for Oslo Rock Festival. The concert featuring the black metal group Mayhem has now led the political majority to want to strip the rock festival of municipal financial support." ("Politiker-korstog mot rockfestival." *Dagbladet*, Aug. 13, 1996)

music and image reinforced a contrarian identity by emphasizing aesthetic features of darkness and contrast.

Hypothesis 2a (H2a): Black metal bands increase the level of colorfulness and reduce contrast (on their album covers) in response to the stigmatization of black metal.

Black metal's association with bands in the commercially oriented heavy metal scene may provoke a reversal when the black metal bands interpret such association as presenting a threat to the fundamental, contrarian identity of the genre. Furthermore, the need for distinction among a population of bands may drive some of them to abort the use of elements endorsed by mainstream players (Askin and Mauskapf, 2017). We anticipate that the increasing global commercial success of black metal would motivate efforts to return the genre to its underground roots and to reassert a traditional identity by reducing the use of color and by increasing the use of contrast on album covers. Reversals of this kind result from the tensions generated by the commercialization of countercultural products (e.g., Becker, 1982; Fine et al., 1998; Patterson, 2013) that often lead to bifurcation into moderate and radical sections (Fine, 2001). Ihsahn, of Emperor, remarked in a 1997 interview on "bands that are just kind of a nicer version of black metal. . . . and those who tend to go backward and play more primitive thrash and older, more Celtic Frost-inspired black metal."[9]

The visual domain is important because it allows bands to resolve or alleviate an identity paradox that emerges when a formerly underground genre experiences growing sales and interest by larger record labels. Album covers increasingly communicated the message that band members were not "sellouts" and were still a "part of the scene that existed up until '93, not the one existing now" (Faust, of Thorns, in *Slayer Magazine*, May 1998). In H2a we posit that black metal bands use color to respond to the threat of negative social attention and sanctions; H2b articulates the expectation that black metal bands use color to

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[9] Available (in archived form) at:
https://web.archive.org/web/20220121014228/http://www.chroniclesofchaos.com/articles.aspx?id=1-138.

protect their contrarian identity from another external threat: the perception of excessive market success. This hypothesis captures how color can become tied to a relational identity that evolves in response to the opposing social forces of association and dissociation (Simmel, 1957).

> **Hypothesis 2b (H2b):** Black metal bands reduce the level of colorfulness and increase contrast (on their album covers) in response to the commercialization of black metal.

Our last hypothesis captures internal relations between the elements of a style (Godart and Galunic, 2019). Sound and image are the two most relevant loci of attention in the music industry, and their alignment is generally desired (Formilan, 2021). Black metal band members often invoke images and visual references when discussing their music. For Euronymous, of Mayhem, "we are inspired both musically and lyrically by the evil nature of the northern lands and the darkness and cold up here" (TSV #15, 1993), while Ihsahn, of Emperor, described their latest album as a "soundtrack to the most epic, violent, dark movie ever! With our music we wanted to paint endless dark forests" (Metal Hammer, July 20, 2017). Accordingly, we expect to observe alignment between music content and the projected image. The content can be categorized according to its perceived purity: the degree to which it reproduces musical and/or ideological canons (Solomon, 2005). Dividing the bands into "pure" and "hybrid" based on whether the content hews to black metal conventions or draws on other genres, we expect that pure bands would display stronger preference than hybrid bands for dark colors and black-and-white contrast on their album covers. This alignment expresses a relational identity and is expected to endure over time.

> **Hypothesis 3 (H3):** Pure black metal bands display lower levels of colorfulness and higher levels of contrast (on their album covers) than hybrid black metal bands do.

Data and Methods

Our main data source is Encyclopaedia Metallum: The Metal Archives—the most comprehensive online resource on heavy metal. We collected the cover images for all Norwegian band releases in all metal genres during the period 1989–2019. This amounted to 5,186 cover images, of which 2,899 images pertained to black metal. We visually inspected all images and identified 537 with a defect (i.e., when the original image had obtained a yellowish veneer), which we managed to remove for 367 of them. We replaced 56 irreparable images with higher-quality images and improved the state of 170 images. Our final sample includes 5,125 cover images, of which 2,876 are for black metal.

We did not collect images for international bands, as we had strong reasons to prioritize the local metal scene. Albeit influenced by foreign bands, Norwegian black metal evolved as an inward-looking community (e.g., Moynihan and Søderlind, 1998; Patterson, 2013); the country's small area and the small size of the local music scene facilitated mutual observation and interaction between bands and across genres. We assume that the sampled reference group (Norwegian non-black metal bands) was largely representative of non-black metal bands worldwide in terms of their aesthetic and musical content.

From the Metal Archives, we collected detailed band-level information, including discography, lineup, and genre for all Norwegian metal bands. From the same source, we also gathered data on the formation of black metal bands in the world. Finally, we collected all news press articles that mention "black metal" for the period of observation, available through the Norwegian database Retriever/Atekst.

A Computational Approach to Color

An important reason that organizational scholarship reveals low interest in color is the lack of an established procedure for color analysis. Efforts at quantification are still rare, with probably the most notable originating in sociology. In her analysis of national flags, Cerulo (1995) developed a procedure to capture the structure and relation of colors, counting their

number and the proportion of secondary colors in a flag. Her analysis confirms the importance of external relations. Nations tend to have similar combinations of colors as those of their principal reference group: the nations that border them. Colors tend to differ significantly from those of one's historical rival, testifying to the practice of positioning through differentiation in aesthetic space.

Whereas the symbolic content of color is of secondary importance to Cerulo (1995), it is essential in our analysis of positioning by means of color. But the most notable difference is methodological. Recent technological advancements have facilitated the development of algorithms to extract color information from digitized images, enabling more-comprehensive measures than a simple count of colors. We describe below an algorithmic routine that we developed to process digitized images.

In general terms, a digitized image can be defined as a spatial arrangement of tridimensional RGB vectors (pixels), where R, G, and B refer to the color's red, green, and blue components and range from 0 to 255. Lower RGB values result in less bright and intense colors. Analytically, each image can therefore be described by an N × 3 matrix, where N is the number of pixels that compose the image, and 3 refers to each pixel's RGB components. Given the large pixel-wise size of digital images, we require a technique to reduce the dimension of an N × 3 matrix and yield a color palette—a set of representative colors appearing in an image. Through mathematical conversion, we can compute for each color its hue, saturation, and luminance representation (Figure 2), which reflects the way the human eye perceives color attributes (Wyszecki and Stiles, 2000).

[Insert Figure 2 About Here]

Data preparation. Our preparation of each image for analysis involved three steps (Figure 3). First, we resized each image to a standard 200 × 200 pixel square to ensure reliable comparison. Second, we extracted the RGB components of each pixel. For each

image, RGB extraction resulted in a 40,000 × 3 matrix, composed of 40,000 vectors of 3 RGB elements each. We then used k-means clustering (Hartigan and Wong, 1979) to partition the 40,000-pixel vectors into five clusters and took the RGB centroids of each resulting cluster as a representative color for that cluster. The average quality of the five-cluster partitioning was 94.366 (S.D. = 3.837, median = 95.194), confirming that the five-cluster palette effectively summarized the relevant color information of each image.

[Insert Figure 3 About Here]

Cluster-level information: Luminance and saturation. For each image, we computed the luminance of its five constituent clusters. *Cluster luminance* measures the luminous intensity of the focal cluster as a weighted combination of its RGB component. As depicted in Figure 2, luminance captures the brightness of a color—the "attribute of a visual perception according to which an area appears to emit, transmit or reflect, more or less light" (CIE, 2000). Mathematically, the standard luminosity function is as follows:

$$L_c = 0.2126 R_c^\gamma + 0.7152 G_c^\gamma + 0.0722 B_c^\gamma$$

where R_c, G_c, and B_c are the red, green, and blue components of the focal cluster c, respectively; $\gamma = 2.2$ is the industry-standard value used to compensate (expand) the compression applied to digitally stored images; and the three coefficients reflect the different sensitivities of the human eye to red, green, and blue (see Hunt, 2005; Rosi et al., 2016).

A second cluster-level measure is *Cluster saturation*, a quantification of the colorfulness of an area judged in proportion to its brightness. Saturation is the intensity or purity of a color, which is determined by how much light it emits or reflects (Figure 1, Saturation). Mathematically,

$$SAT_c = \frac{max(RGB_c) - min(RGB_c)}{max(RGB_c)}$$

where *max(RGB_c)* and *min(RGB_c)* are the largest and smallest values, respectively, among the RGB components of the focal cluster c.

Image-level dependent variables: Image colorfulness and image contrast. We used the full RGB and five-cluster color information to create our dependent variables, *Image colorfulness* (a compound measure) and *Image contrast.* The first component of image colorfulness, *Weighted saturation,* measures the color saturation of the focal image *i* as the average value of the color saturation of its clusters weighted by their pixel size. Mathematically,

$$Weighted\ Saturation_i = \frac{\sum_{c=1}^{n} SAT_c \cdot S_c}{\sum_{c=1}^{n} S_c}$$

where *n* is the number of clusters, and S_c is the pixel size of each cluster. A high saturation value implies that the corresponding image is intensely colored, while a low saturation value signals that the colors of a focal image are hardly distinguishable from black, white, or shades of gray (Figure 2, Saturation).

The second component of image colorfulness, *Color entropy*, is a measure introduced in Shannon's (1948) information theory to capture the diversity of elements (or disorder) in a signal. Widely used in quantitative research on image analysis and classification (see Ivanovici et al., 2020), it is mathematically computed as

$$Color\ Entropy_i = -\sum_{RGB=1}^{n} P_{RGB} \log P_{RGB}$$

where *n* is the number of RGB vectors in the focal image *i*, and P_{RGB} is the proportion of occurrences of each RGB vector in the image. A high value of color entropy implies that the focal image includes many distinct colors, while low values correspond to plain, single-color images. The *Image colorfulness* measure represents a linear combination of a focal image's *Weighted saturation* and *Color entropy* components, simultaneously capturing the intensity and distribution of colors in the cover image.

Our second dependent variable, *Image contrast*, takes the average of the two darkest clusters and the average of the two brightest clusters, to calculate the degree of difference on luminance. Mathematically,

$$Image\ Contrast_i = \sum_{c=1}^{2} L_c - \sum_{c=n-1}^{n} L_c$$

where L_c belongs to the ordered set of cluster luminance values $L = (L_1, \ldots, L_n)$. Group-based contrast controls for the size of different clusters by aggregating small clusters with larger ones on the basis of proximate luminance levels. An image ranks high in contrast when the perceived difference between bright and dark areas is pronounced (e.g., a black/white image), while an image ranking low in contrast features proximate shades of the same color (see Figure 4).

[Insert Figure 4 About Here]

Validation of measures. To ensure that our algorithmic measures correspond to the way the human eye perceives properties of colors, we designed a picture-sorting survey (details are reported in the Online Appendix). We first presented five images to participants and invited them to take time to consider their colors and color composition. Then, we asked them to order the five images by decreasing colorfulness (first task) and contrast (second task). These tasks make explicit the relational nature of colors, whose properties can be meaningfully assessed only by comparison (Lobinger and Brantner, 2019). We distributed the survey online to students at two European business schools and received 170 valid responses. We excluded 14 responses in which technical glitches related to the ordering of the images interfered with completion of the task.

We created three measures, shared in the Online Appendix, to assess the alignment between the algorithm and human perception in the colorfulness- and contrast-based tasks: respondents' agreement over the full order of the images (Formula A), their agreement over

the position of each image in the order (Formula B), and Cohen's weighted kappa statistic of inter-rater agreement (Everitt, 1968; Formula C).

[Insert Figure 5 About Here]

Results are reported in Figure 5, corroborating the validity of our measures. Seventy-three percent of respondents agreed with the algorithm on the average full ordering of the images on the colorfulness and contrast scales, and 79 percent and 78 percent agreed on the exact position of items on the colorfulness and contrast scales, respectively. Cohen's kappa statistic is at .85 and .84 for colorfulness and contrast, respectively. The results show a high level of agreement between the algorithmic computation of colorfulness and contrast and human perception of these dimensions.

Independent Variables

To test our hypotheses, we constructed several variables that capture the dynamics of color choices over time and the social influence to which the bands were exposed. We relied on two-year variable lags to allow sufficient time for cover images to diffuse and influence the production of subsequent releases. For H1, two variables capture the *Median cover image colorfulness per year (lag),* and two more capture the *Median cover image contrast per year (lag)* for black- and non-black metal bands, respectively. These variables measure the extent to which past choices influenced the current aesthetic choices of black metal bands.

To test H2a and H2b, we created two variables. The first captures the stigmatization of the genre by counting the number of major news articles per year denouncing black metal during our observation period in Norway. An established procedure for capturing stigmatization processes is through public discussion in the form of newspaper articles (e.g., Becker, 1963). To ensure the measure reflects the public outcry and social pressure on the genre, we used together the keywords "Satanist," "arson," and "black metal" to filter our search results. The distribution of the variable, *News articles stigmatizing Norwegian black*

metal per year (lag), reassured us regarding its appropriateness; it displays the expected pattern of a huge increase in the number of negative articles on black metal between 1994 and 1995, when the genre was subjected to massive negative media coverage.

The second measure is designed to capture the commercialization of the genre. Ideally, we would capture this process through album sales, but these data are not accessible. We decided instead to create a measure of the number of commercial Norwegian black metal releases per year. The number of releases by record labels is a suitable indicator of the degree to which a genre is becoming acceptable or prevalent in the record industry and in heavy metal. The distribution of the variable *Number of commercial Norwegian black metal releases per year (lag)* confirms the expected pattern: almost no commercial releases before 1993, a tendency for a growing number of releases starting in 1995, and a median value for the distribution in 1999. Our commercialization measure captures two processes at the same time: increasing legitimacy and sales and increasing competition. To try to disentangle these, we feature a control variable that captures the degree of competition in black metal.

To test H3, we constructed the indicator *Pure black metal band*, which distinguishes bands that draw on different genres in their music and those that perform what is perceived as pure black metal. It captures whether a band pursues a clear black metal identity or is better categorized as hybrid in terms of music content. The indicator was calculated from user-generated classifications of bands and takes the value of 1 if the band is a pure black metal band and 0 if a hybrid.

Our last predictor is featured not in our main models but in the supplementary analyses. It is categorical, distinguishing different periods and providing an alternative specification of the temporal dependencies in H2a and H2b. It takes the value of 2 for the underground period (1989–1993), 1 for the stigmatization period (1994–2000), 3 for the

commercialization period (2001–2008), and 4 for the last period (2009–2019). The stigmatization period is the reference category.

Control Variables

Several variables capture characteristics of the bands that may affect black metal bands' color choices on their album covers. *Band age* measures years since band formation. It controls for differences between early- and late-career stages; younger bands are likely to develop a more aggressive aesthetic presence by way of a darker palette or more-intense contrast. We also controlled for the location of a band. Norwegian black metal is largely a rural phenomenon (Moynihan and Søderlind, 1998: 69), arising in defiance of a conservative local culture and a sociopolitical order associated with big cities in Norway. We labeled bands located in the cities Oslo, Bergen, Trondheim, and Stavanger as *Urban* and assigned them the value 1 (and 0 otherwise). We expect that urban bands are more exposed to popular culture and more likely to incorporate colorful elements into their album covers.

The indicator *Formed pre-1994* (value of 1, 0 otherwise) designates bands active in the underground scene (before 1994). These bands are generally perceived as representing the genre's transgressive values and as more authentic or credible than the bands formed after 1994 (Moynihan and Søderlind, 1998; Sgourev and Aadland, 2022). We expect that higher underground authenticity is likely associated with a proclivity for contrast and darker colors.

We added a measure capturing the number of *Black metal band formations outside Norway per year (lag)*. This variable captures the "carrying capacity" of the emerging genre (see Ruef, 2000): the higher the number of black metal bands in the world, the greater the legitimacy of the genre and the more intense the competition in it. We expect that the increasing competition may encourage Norwegian bands to differentiate by enhancing color or intensifying contrast.

Finally, we controlled for variance at the level of the album release by creating an indicator that takes the value of 1 if the album cover was for a *Demo release* and 0 otherwise. This is another control for career stage at the band level, allowing us to differentiate between official and unofficial releases. This distinction likely correlates with audacity in color choices, as a band that has no record deal has greater license to experiment musically and visually in their releases and is likely to pursue a more emphatic visual presence.

In supplemental analyses, the indicator *Non-black metal band* distinguishes bands that play black metal from those in other metal genres (e.g., thrash metal, death metal, etc.).

Results

Table 1 presents the descriptive statistics for the variables in the analysis and the correlations. The mean values attest to the strong international growth of black metal, captured in the number of band formations worldwide. A high proportion of the releases are demos (26 percent), revealing that a significant number of images correspond to unofficial releases. About one-third of the releases are by bands located in an urban area, confirming that black metal in Norway is a largely rural phenomenon (Moynihan and Søderlind, 1998). The historical weight of the underground period is captured in the fact that 28 percent of all releases are by bands formed before 1994. Finally, there is a nearly equal divide between the number of releases by pure and by hybrid bands.

[Insert Table 1 About Here]

Before presenting the regression results, we examine plots of the distributions over time. Figure 6 shows the plot of the annual mean *Image colorfulness* for non-black metal bands and for the two types of black metal bands (pure and hybrid). The average for the black metal category is situated between the pure and hybrid lines. The cover images released by black metal bands display a lower level of colorfulness relative to non-black metal bands

throughout the observation period, confirmed by the results of a t-test: the means for black metal (n = 2876, mean = 9.248, S.E. = .065) and non-black metal releases (n = 2249, mean = 10.874, S.E. = .070) are significantly different (t = 16.853, p < .000).[10]

[Insert Figures 6 and 7 About Here]

Figure 7 shows the plot of the annual mean *Image contrast* for the different sets of bands. It reveals that the cover images of black metal releases display a higher level of contrast than do non-black metal releases throughout the observation period, with the exception of a short period when the lines intersect. The means for black metal (n = 2876, mean = .467, S.E. = .003) and non-black metal releases (n = 2249, mean = .451, S.E. = .003) are significantly different (t = –3.292, p < .001).

These plots provide preliminary evidence that black metal bands position themselves relative to non-black metal bands at a lower level of colorfulness and higher level of contrast. The plot lines are highly correlated (.68 on colorfulness and .66 on contrast) and move in parallel over time, implying interdependence. However, black metal appears to resolutely keep its distance from the other genres. The magnitude of the difference increases over the second half of the observation period, but the black metal trend line continues to move in parallel to the reference group.

As Figure 6 reveals, colorfulness is lowest in the underground period (1989–1993), when lack of visibility and commercial prospects contributed to a somber aesthetic presence. The degree of colorfulness starts to increase in the stigmatization period (1994–2000). The t-test results testify to a significant difference (t = –7.868, p < .000) between the means for the underground (n = 101, mean = 7.969, S.E. = .284) and for the stigmatization periods (n = 518, mean = 10.499, S.E. = .148), providing initial evidence that black metal responded to its stigmatization by moving away from the dark, underground aesthetic.

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[10] We performed two-way t-tests, using groups for unpaired data with unequal variances.

As the intensity of stigmatization abates in the late 1990s, black metal is more accepted. The colorfulness level decreases again in the commercialization period (2001–2008). The t-test confirms that the mean for this period (n = 872, mean = 9.148, S.E. = .117) is significantly lower than the mean for the previous period (t = 7.126, $p < .000$).

Contrast is highest in the underground period (Figure 7), reflecting a confrontational stance indicated by juxtaposition of black and white. This stance is moderated in the stigmatization period: the group means for this period (n = 518, mean = .475, S.E. = .007) are significantly different from those of the previous period (n = 101, mean = .550, S.E. = .016) (t = 4.080, $p < .000$). Around 2000, the degree of contrast in black metal bands' cover images is at the same level as that of non-black metal bands, confirming the moderation observed on colorfulness. The means for the stigmatization and commercialization periods are not significantly different (t = .022, $p < .681$). The use of contrast declines somewhat in the second half of the observation period, but the decline is more pronounced for non-black metal bands.

The trend lines for pure and hybrid black metal bands (Figure 6) are highly correlated (.83), moving in parallel over time. But pure black metal bands display a consistently lower level of colorfulness in cover images compared to hybrid bands. The means for pure black metal releases (n = 1548, mean = 8.903, S.E. = .088) and for hybrid releases (n = 1328, mean = 9.649, S.E. = .097) are significantly different (t = 5.679, $p < .000$).

This difference is smaller in the underground period, when both sets of bands appear equally undisposed to color. It increases noticeably in the commercialization period, when hybrid bands, combining elements from other metal (and non-metal) genres, started adding color to a greater extent than did pure bands, which remained more committed to the traditional, dark identity of the genre.

The observed alignment between content and image is less apparent on contrast (Figure 7). The means for pure and hybrid releases are not significantly different (t = .584, *p* < .598). For both sets of bands, the degree of contrast is highest, as expected, in the underground period, declining thereafter. Over the observation period, the decline appears to be a bit more pronounced for hybrid bands.

Mixed-Effects Regressions

We test our hypotheses by estimating mixed-effects regressions, predicting the degree of colorfulness and contrast of black metal cover images, conditional on covariates with a band-specific intercept. This random intercept ζ_j can be considered a random parameter that is not estimated along with the fixed parameters β_1 through β_p but whose variance ψ is estimated together with the variance θ of the ϵ_{ij} (Rabe-Hesketh and Skrondal, 2008). The level-2 residual ζ_j is a band-specific error component that remains constant across releases, while the level-1 residual ϵ_{ij} is a release-specific error component that varies between releases and between bands$_j$. The band-specific error component ζ_j represents the combined effects of omitted band characteristics or unobserved heterogeneity.

[Insert Table 2 About Here]

Model 1 in Table 2 features the control variables, predicting the degree of colorfulness. We find no significant effect of band age or evidence of a significant relationship between color choices and the degree of global competition as captured by *Black metal band formations outside Norway per year (lag)*. Urban bands display lower levels of colorfulness than rural bands (–.435, *p* < .05). The coefficient for the variable *Demo release* is negative and significant (–1.626, *p* < .001), indicating that an unofficial release is likely to display a lower degree of colorfulness than an official release displays. This confirms that bands in the shadows, i.e., unsigned and/or in the underground, are more likely to manifest a somber aesthetic presence on their covers, hewing to black metal conventions. Interestingly,

bands formed before 1994 are more likely to increase colorfulness on their covers than are bands formed after 1994.

Model 2 introduces the pair of variables capturing the past color choices of black metal and non-black metal bands. Both coefficients are positive and significant: *Median black metal image colorfulness per year* (.152, *p* < .01) and *Median non-black metal image colorfulness per year* (.265, *p* < .01). The results confirm that black metal bands observe one another, but more important, they pay close attention to the aesthetic choices of the non-black metal reference group. Model 2 provides strong evidence of association between the choices of black metal bands and the past choices of non-black metal bands, as the former tend to increase the degree of colorfulness in response to an increase by the latter.

Model 3 tests H1 by introducing the variable *Median non-black metal image colorfulness per year* squared. The coefficient is negative and significant (–.067, *p* < .05), whereas the main effect of the variable is positive and significant (1.663, *p* < .05), indicating an inverse U-shaped curvilinear effect. Black metal bands associate with the choices of non-black metal bands on colorfulness up to a point, after which they are likely to start disassociating from them by decreasing the colorfulness of their album covers. This provides evidence in the aesthetic domain that practices of imitation create preconditions for the pursuit of differentiation (Tarde, 1897; Askin and Mauskapf, 2017). Past a certain degree of association, black metal bands are likely to adopt more-muted colors than the reference group uses, to assert a distinct visual identity.

The next two models test H2a and H2b. Model 4 adds our measure of stigmatization, *News articles stigmatizing Norwegian black metal per year (lag)*. The coefficient is positive and significant (.061, *p* < .01), confirming the expectation that black metal bands are likely to increase colorfulness on their album covers as a response to increasing social pressure and negative media coverage. The use of color as a normalizing tool to project an identity and an

image that contest a negative social evaluation echoes a familiar response to stigmatization and the threat of sanctions (Elsbach, 2003; Hudson, 2008).

The period of moderation in black metal was instrumental in the genre's later commercialization. We add the measure of commercialization (*Number of commercial Norwegian black metal releases per year*) in Model 5. The significant negative effect (–.013, $p < .001$) provides support for H2b. As the number of commercial releases increases, the bands are more likely to decrease the degree of colorfulness on their covers. The darkening of the color palette articulates a reaction to the growing popularity of the genre. Commercialization led to polarization, with some bands riding that wave and others trying to distance themselves from the part of the scene viewed as having betrayed its underground origin (Patterson, 2013: 313). These latter bands chose a basic aesthetic, poor production standards, and limited release of their albums to reclaim what they perceived as an underground identity (Patterson, 2013).

Model 6 introduces the *Pure black metal band* indicator. The coefficient is negative and significant (–.653, $p < .001$), demonstrating that releases by pure bands are more likely to display lower levels of colorfulness than those by hybrid bands, supporting H3. These results reinforce the collected evidence for the alignment between music content, aesthetic form, and identity in Norwegian black metal. The full model, Model 7, reintroduces the squared term. The coefficients of interest appear robust, displaying significance at the accepted levels. The results (Model 2–7) imply that black metal bands are more attentive to the color choices of non-black metal bands than to those of their black metal peers; the postestimation analysis confirms the relative importance of the designated reference group. Figure 8 plots the curvilinear effect of *Median non-black metal image colorfulness per year* in the full model.

[Insert Figure 8 and Table 3 About Here]

Table 3 reports the results of the analysis of contrast. The control variables in Model 8 present some evidence that bands reduce the use of contrast over the course of their careers and that bands formed before 1994 tend to feature a higher degree of contrast on their album covers. The results confirm that *Demo releases* are more likely to display a cover image juxtaposing black and white than are official album releases (.041, $p < .001$). A more aggressive visual presence may be motivated by the perceived need to reinforce black metal conventions but also by the desire to attract attention as an emerging band.

Model 9 introduces the lagged *Median black metal image contrast per year* and *Median non-black metal image contrast per year*. Only the latter coefficient is significant (.330, $p < .05$), attesting that black metal bands take into consideration the reference group of non-black metal bands' decisions about contrast. The introduction of the squared term in Model 10 provides no evidence for a nonlinear effect; the established effect appears linear.

The introduction of the measures of stigmatization and commercialization in Models 11 and 12 offers no evidence that bands adjust the contrast level in response to these developments. There is also no evidence that hybrid black metal bands are less likely to use contrast on their covers, compared to pure bands. These results suggest that in their aesthetic decisions, black metal bands give priority to color, rather than contrast, as a device for positioning. Both between- and within-band variance is lower in the contrast than in the colorfulness models. This is comprehensible given that colorfulness is a more visible and cognitively accessible visual dimension than contrast. We further explore this observation in supplementary analyses.

Supplementary Analyses

For additional insights into the results on *Image contrast,* we estimated quantile regression models for the median, the 25th percentile, and the 75th percentile of the distribution. The results of the 75th percentile model show that black metal bands in the upper quartile respond

to commercialization by increasing contrast. The coefficient for *Commercial Norwegian black metal releases per year* is positive (.0004) and significant ($p < .045$). We also divided the *Image contrast* variable into quartiles with increasingly higher levels of contrast, estimating a partially constrained generalized ordered logit model (Williams, 2006). The results are comparable to those for Model 13 in Table 3. It is notable that the coefficient for *Commercial black metal releases per year* is positive (.003) and significant ($p < .058$) only for the top quartile of *Image contrast*. This reinforces the prior observation that the commercialization of black metal tends to have a strong impact only at higher levels of contrast. These results suggest that only big changes in contrast are perceived as socially meaningful by viewers, while our algorithm is able to capture fine-grained distinctions.

We performed additional analyses to bolster the robustness of our results. To reinforce the evidence for distinct relational identities, we estimated multilevel mixed-effects models on the full sample of both black and non-black metal bands' cover images. The results demonstrate that black metal bands are significantly more likely to display lower levels of colorfulness on their album covers (–1.309, $p < .000$) than are non-black metal bands, corroborating the pattern in Figure 6. The results for *Image contrast* confirm that black metal bands are more likely to display higher contrast (.016, $p < .034$) than are bands in other metal genres, as observed in Figure 7. We also use the full sample to explore further the parallel trend on colorfulness (Figure 6) during the stigmatization period. The interaction between *News articles stigmatizing Norwegian black metal per year (lag)* and *Non-black metal band* is not statistically significant, while for black metal bands, the conditional main effect of the stigmatization variable is positive and significant (.052, $p < .006$). There is evidence relating the observed trend for black metal bands to the stigmatization process, but not for non-black metal bands.

For an alternative test of H2a and H2b, we estimated models of *Image colorfulness* and *Image contrast* on the sample of black metal cover images, featuring the categorical variable that distinguishes different periods in the genre's history. Results show that bands are significantly less likely to display color in the underground period relative to stigmatization (–1.567, $p < .000$) and in the commercialization period relative to stigmatization (–1.074, $p < .000$), supporting the expectation that the degree of colorfulness would increase in response to stigmatization and decrease in response to commercialization. *Pure black metal bands* are more likely than hybrid black metal bands (–.642, $p < .000$) to exhibit lower levels of colorfulness, reinforcing H3. The results for *Image contrast* are relatively less compelling, showing that bands are more likely to increase *Image contrast* in the underground period relative to the stigmatization period (.040, $p < .026$).

We reestimated the colorfulness and contrast models in Tables 2 and 3, clustering the standard errors on year, and the results remain stable. We then reestimated the models by clustering on the record label, to address the possibility that the record label significantly influences aesthetic choices, such as by having a professional designer create album covers for bands. Once again, results remain stable, suggesting that uncontrolled label-specific correlations among cover images do not influence the observed patterns. This confirms our impression from interviews and popular accounts (Patterson, 2013) that bands retain control over their album covers. We established in additional analyses that most labels that signed black metal bands in the 1990s were small in size, largely focused on distribution, and unlikely to assist with album cover design.

Discussion

Organizational scholarship on aesthetics has grown spectacularly in the last decade (e.g., Meyer et al., 2013; Boxenbaum et al., 2018), reaching a critical mass that recommends

synthesis (Baldessarelli, Stigliani, and Elsbach, 2021). Yet the absence of sustained attention to relational processes motivated our approach to place these processes at the center and to investigate their implications for the construction of meaning through color. There is ample evidence that visuals function as symbolic devices that influence the perceptions of audiences (Meyer et al., 2013: 503). But visuals can be more than that when activated as positioning devices that connect relations, actors, and objects into relational identities.

This article contributes by developing a framework for relational analysis based on computational methods for visual analysis. We applied this framework to a social element that is simultaneously highly visible and analytically invisible (Pastoureau, 2008). To bolster the framework's theoretical value (Rose-Greenland, 2016), we conceptualized color as embedded in internal relations among the elements of a style (Godart and Galunic, 2019) and in external relations to reference groups. A key function of color in markets and everyday life is to enable positioning by way of association and disassociation (Simmel, 1957), imitation and differentiation (Tarde, 1897). Color constitutes both an active element and a product, not only expressing reality but helping to construct it (Meyer et al., 2013).

We validated the framework by analyzing the cover images of black metal album releases, showing how bands navigate aesthetic space by balancing imitation of and differentiation from other bands and by reacting to threats of social sanctions and perceived excessive market success. These practices emanate from mutual observation: cultural producers position themselves relative to those they view as relevant in decisions on the content, form, or pricing of products (White, 1992). The analysis shows that bands positioned themselves relative to other bands in commercially oriented heavy metal (e.g., Moynihan and Søderlind, 1998; Patterson, 2013). Supporting Hypothesis 1, we identified a curvilinear relationship whereby black metal bands are likely to associate with the color choices of the reference group up to a point, beyond which association gives way to differentiation.

This dynamic is familiar from past studies (Tarde, 1897; Simmel, 1957; Askin and Mauskapf, 2017) but has not been documented in full color. Black metal bands reproduced aesthetic conventions associated with the reference group but also sought to maintain distance from them. The color black allowed these bands to affirm their resistance to the colorfulness of popular culture and to the whiteness of institutional religion. The duality of blackness is fundamental (Adorno, 1997): by asserting it in a negative way as an expression of resistance, the bands used it in a positive way to construct a relational identity. Scholars have recognized that relational identities may emerge on the basis of objects, facilitating processes of legitimation and contestation (Sgourev, 2021). In this context, black color was activated in "White" space, denoting the essential form of interplay between identity and social relations in the framework of White (1992).

Duality is also evident in how the bands adapted to external events, leading them to reinterpret archetypical symbolic associations of the color black. As we predicted, the aesthetic position of low colorfulness and high contrast in the underground period was tempered in response to increasing stigmatization. The intense social pressure on black metal in the mid-1990s encouraged bands to try to normalize by adding color and reducing contrast. Our analysis thus reinforces prior evidence showing that organizations project an image to challenge negative evaluations (Hudson, 2008). But as stigmatization abated and black metal started selling on a global scale, the use of color increasingly reverted to the desaturation (black-and-white) mode signifying resistance. A limited palette of muted colors allowed bands to articulate opposition to the genre's commercialization by reclaiming connection to the authenticity of the underground period (Patterson, 2013).

The pursuit of authenticity is a key dimension of differentiation within black metal (Sgourev and Aadland, 2022), as manifested in the adoption of genre conventions in music or aesthetics. As we predicted in Hypothesis 3, we found that the use of color depends on the

degree to which bands pursue purity by reproducing black metal conventions. Bands playing

pure black metal are more likely to display commitment to the traditional dark aesthetic than

are hybrid bands that draw on other music genres. The results demonstrate alignment between

content, form, and identity, reinforcing Godart and Galunic's (2019) insistence on the need to

consider not only relations between producers and elements but also relations among

elements, as they help to identify and position firms in markets (White, 1992; Swidler, 2001).

A necessary caveat is that data limitations imposed a basic operationalization of the pure–

hybrid dichotomy. Additional work is needed to capture the dynamic nature of the formation

and contestation of authenticity (e.g., Becker, 1982) in this context.

Our attention to the alignment between music content and visual representation is

motivated by the assumption that the visual, material, and verbal realms are complementary

(Boxenbaum et al., 2018). We recognize the multimodal nature of symbolic communication

(Meyer et al., 2013), but our contribution is to visual analysis. In contrast to the tendency in

visual analysis of importing theoretical insights and methodologies from the linguistic

domain (Frosh, 2003), we assume that images represent more than simple add-ons to verbal

texts (Kress and Van Leeuwen, 2001). Similarly, we recognize that the material and visual

orders interact (Jones and Svejenova, 2018) and that an object's color may be thought of as

an aspect of either its visuality or materiality (Boxenbaum et al., 2018: 600), but we assume

that color is irreducible to the visual side of materiality and analyze it as a distinctly visual

element.

Our theoretical framework recognizes the role of market demand by way of the

observed impact of the genre's commercialization but focuses substantively on the supply

side. The assumption that color choices are primarily oriented toward other producers (e.g.,

Cerulo, 1995) is supported by accounts testifying to the self-referential nature of black metal

and its inattention to market demand in its formative period (e.g., Moynihan and Søderlind,

1998; Patterson, 2013). Given the preponderance of demand-side studies, renewed attention to the supply side is valuable when it provides new insights into classic questions such as the positioning of entrants vis-à-vis incumbents and the extent to which the former should imitate or differentiate from the latter (e.g., Porter, 1985).

Probably the most distinctive contribution of our analysis is its explication of the role that color can play in such "positional games" (Baxandall, 1985) by organizing information exchanges between producers and helping identities emerge, in addition to more-familiar product features such as price, design, or craftsmanship (e.g., Caves, 2000). There is evidence of the growing role of color not only in the history of art (e.g., Graddy, 2013) but also in the capitalist economy (e.g., Lipovetsky and Serroy, 2013), which suggests the need for more attention to color as a principle of differentiation in strategic positioning.

Our analysis reinforces the recent "endogenous turn" in accounts of the creative industries (Godart and Galunic, 2019) that interpret market outcomes in terms of the positioning of cultural products and producers (e.g., Askin and Mauskapf, 2017). The theoretical importance of internal mechanisms of social differentiation and meaning-making is growing (Lieberson, 2000; Kaufman, 2004), as these mechanisms articulate how the pursuit of legitimacy and distinction among a population of cultural producers drives the adoption of elements. Naturally, exogenous factors intervene in endogenous dynamics (Isaac, 2009), encouraging adaptation to external events such as stigmatization. These processes can be examined from a demand-side perspective, featuring, for example, producers that use color to signal product quality to customers (Spence, 1973). This perspective appears more pertinent to black metal's period of commercialization, when questions of authenticity and product quality loomed larger.

The positioning capacity of color does not imply that color is reducible to a mere positioning device. We attributed to color secondary agentic properties (Gell, 1998),

recognizing the emergence of a convention in the mid-1990s that associated the genre with the color black and thereby influenced bands' aesthetic choices. Thus bands reverted to blackness in response to commercialization, as black had come to epitomize the authenticity of the genre. This color enabled social organization around a coveted identity but also reinforced social exclusion in the stigmatization period because of black's symbolic association with criminal activity. Pastoureau (2008) reminds us that color has been extensively used in history for purposes of designation and exclusion, maintaining lines of division between social groups and shaping collective identities. As we demonstrated, the coloring of identities can facilitate the crystallization of oppositions underlying the creation of new genres (Lena and Peterson, 2008; Sgourev, 2021).

Generalizability and Future Research

The relationships featured in this study are not context-specific and can be observed in cultural industries (e.g., Caves, 2000) and beyond. What may be context-specific is the degree to which the color black is invested with symbolic meaning. The prominence of black is a key reason that we chose black metal as a research context. Yet what we observed here is not unprecedented. Consider the pioneer of countercultural blackness in the late 1960s: the Velvet Underground. At a time when counterculture was awash in color, the members of the Velvet Underground dressed provocatively in all black to make a statement against both the colorful hippie movement and popular bands at the time. Similar to its role in black metal, the color black served to unify experimental music of distortion and dissonance, nihilistic topics in lyrics, and aesthetic non-conformism, creating a network of meaning.[11]

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[11] The Velvet Underground's most innovative album is *White Light/White Heat* (1968), taking distortion to unprecedented heights. Its all-black album cover contrasted sharply with the Andy Warhol-designed cover of their first album. References to "black" are rife in their lyrics, such as in "here he comes, he's all dressed in black," describing a drug dealer in "Waiting for the Man" (1967). Blackness receded in importance with John Cale's departure from the band.

Both the rebellious connotation of the color black and the strength of the association between color and identity vary over time (Pastoureau, 2008). The infinite variety of products in creative industries and uncertainty over their value (Caves, 2000) lead to identification of particular stylistic elements as the essence of a producer's identity (Godart, 2018). Color may assume that role, as it did with black metal in the 1990s, but the symbolic meaning ascribed to it depends on conventions and the salience of other stylistic elements. There are opportunities for research on the role of color in social and economic history, linking it to industry dynamics (i.e., competition), cultural conventions, or relational oppositions. More attention is also warranted to the emergence, diffusion, and disruption of color conventions at the industry and organizational levels and to practices of forecasting of trends in the popularity of colors.

We believe that two avenues for future research are particularly promising. The first involves the degree of alignment between color, form, materials, and discourse. Recent methodological advances are making it possible to articulate contemporary plurality in communication modes (Boxenbaum et al., 2018) by relating the use of color to material, visual, and discursive processes. From this angle, the natural next step in our context is to analyze relationships between lyrics, colors, and forms on album covers, to clarify the underlying logic and temporal sequence of the observed positioning mechanism.

The second research area involves further elaboration of the relational approach to color. We articulated color as a social element subjected to an interplay of association and disassociation (Simmel, 1957). The next stage calls for a combination of network and computational methods to capture aesthetic relations in a direct manner. This may include analysis of the social structure of color, exploring how social positions shape the use of color, or how career mobility (e.g., Shipilov, Godart, and Clement, 2017) delineates trajectories of color in social space. It is also possible to engage categorization research by studying the

coloring of relational oppositions, such as when a market category is overlaid with colors (i.e., Coke's red and Pepsi's blue).

We provided a blueprint for the quantification of color that lends itself to broad application. A variety of items can be subjected to such analysis, including product catalogs, corporate logos, book illustrations, artworks, posters, and slideshows, among others. For example, product catalogs make it possible to examine tendencies and firm-level differences in the use of color. As Pastoureau (2008) noted, a limited color palette continues to define products of mass consumption, echoing the early colorless days of industrial production dominated by white, gray, and black. New methods and digital databases enable the identification of patterns in the industrial application of color. Relating these patterns to economic and cultural processes will offer new insights into competitive dynamics and the mutual influence between popular culture and industrial production.

Despite momentous advancements in computational methodology for visual analysis, it is a challenge to recreate the complexity of perception and visualization in our models. We disentangled two principal perceptual dimensions (colorfulness and contrast) for analytical purposes, but in reality, colors are perceived holistically, and the dimensions interact. Thus our supplementary analyses demonstrated an association between the degree of image colorfulness and that of image contrast. This association does not interfere with the reported patterns but invites further attention in research. Our models display a much better fit with the measures of colorfulness than those of contrast, perhaps because contrast is more cognitively taxing to process and is more likely to be used as a positioning device at higher levels, as the quantile regressions show. The analysis of color is interdisciplinary and intrinsically tied to advances in the study of perception in related fields such as psychology and neuroscience (Onians, 2007).

The protean nature of color, which spans objective properties and subjective experiences, natural and social sciences, everyday life and corporate boardrooms, is both a challenge to our theories and methods and a source of exciting opportunities. Color has high economic value: it is indispensable to the functioning of our "artistic" and image-obsessed capitalism (Lipovetsky and Serroy, 2013). But it is also an elastic cultural element that forges surprising historical connections, such as those between the visual austerity of Protestantism, the dramatic cinematography of Bergman, the countercultural appeal of the Velvet Underground, and the resolve of Norwegian bands to explore darkness for real.

Supplemental Material
Supplemental material for this article can be found in the Online Appendix at
http://journals.sagepub.com/doi/suppl/10.1177/xxxxxxxxxxxxxxxx.

REFERENCES

Aasdal, P., and M. Ledang
2008   Once Upon a Time in Norway. Hamar, Norway: Grenzeløs Productions.

Adorno, T. W.
1997   Aesthetic Theory. London, UK: The Athlone Press.

Albers, J.
2013   Interaction of Colour (50th Anniversary Edition). New Haven, CT: Yale University Press.

Aloumi, A., S. Noroozi, B. Eves, and M. Dupac
2013   "The impact of color contrast on the perception of complexity–simplicity of design product." International Journal of Design Creativity and Innovation, 1: 233–254.

Askin, N., and M. Mauskapf
2017   "What makes popular culture popular? Product features and optimal differentiation in music." American Sociological Review, 82: 910–944.

Baldessarelli, G., I. Stigliani, and K. Elsbach
2021   "The aesthetic dimension of organizing: A review and research agenda." Academy of Management Annals, 16: 217–257.

Baxandall, M.
1985   Patterns of Intention: On the Historical Explanation of Pictures. New Haven, CT: Yale University Press.

Becker, H. S.
1963   Outsiders: Study in the Sociology of Deviance. New York: Free Press.

Becker, H. S.
1982   Art Worlds. Berkeley, CA: University of California Press.

Bell, E., S. Warren, and J. E. Schroeder
2014   The Routledge Companion to Visual Organization. Milton Park, UK: Routledge.

Beste, P., and J. Kugelberg
2008   True Norwegian Black Metal: We Turn in the Night Consumed by Fire. Brooklyn, NY: PowerHouse Books.

Beyes, T.
2017   "Colour and organization studies." Organization Studies, 38: 1467–1482.

Beyes, T., and C. De Cock
2017   "Adorno's grey, Taussig's blue: Colour, organization and critical affect." Organization, 24: 59–78.

Bielby, W. T., and D. D. Bielby

1994   "'All hits are flukes': Institutionalized decision making and the rhetoric of network prime-time program development." American Journal of Sociology, 99: 1287–1313.

Bloch, P. H.
1995   "Seeking the ideal form: Product design and consumer response." Journal of Marketing, 59: 16–29.

Boxenbaum, E., C. Jones, R. E. Meyer, and S. Svejenova
2018   "Towards an articulation of the material and visual turn in organization studies." Organization Studies, 39: 597–616.

Breiger, R. L.
1974   "The duality of persons and groups." Social Forces, 53: 181–190.

Cattani, G., S. Ferriani, F. Godart, and S. V. Sgourev
2020   "Introduction: The aesthetic turn in strategy: Creating value with style." In G. Cattani, S. Ferriani, F. Godart, and S. V. Sgourev (eds.), Aesthetics and Style in Strategy (Advances in Strategic Management, vol. 42): x–xxxiii. Bingley, UK: Emerald Publishing Limited.

Caves, R. E.
2000   Creative Industries: Contracts Between Art and Commerce. Cambridge, MA: Harvard University Press.

Cerulo, K. A.
1995   Identity Designs: The Sights and Sounds of a Nation. New Brunswick, NJ: Rutgers University Press.

CIE
2000   "ILV: International lighting vocabulary, 2nd edition." International Commission on Illumination. http://Cie.Co.at/e-Ilv.

Connellan, K.
2013   "The psychic life of white: Power and space." Organization Studies, 34: 1529–1549.

Creed, W. E. D., S. S. Taylor, and B. A. Hudson
2020   "Institutional aesthetics: Embodied ways of encountering, evaluating, and enacting institutions." Organization Studies, 41: 415–435.

DeLong, M., and G. Goncu-Berk
2012   "What color is sustainability?" In M. DeLong and B. Martinson (eds.), Color and Design: 89–100. New York: Berg Publisher.

Devers, C. E., T. Dewett, Y. Mishina, and C. A. Belsito
2009   "A general theory of organizational stigma." Organization Science, 20: 154–171.

Eaton, N.
2012   "Nomadism of colour: Painting, technology and waste in the chromo-zones of colonial India c. 1765–c. 1860." Journal of Material Culture, 17: 61–81.

Eckert, P.

2004 "The meaning of style." Texas Linguistic Forum 47. Proceedings of the Eleventh Annual Symposium about Language and Society, Austin: 41–53.

Elliot, A. J., and M. A. Maier
2007 "Color and psychological functioning." Current Directions in Psychological Science, 16: 250–254.

Elsbach, K. D.
2003 "Organizational perception management." Research in Organizational Behavior, 25: 297–332.

Elsbach, K. D.
2009 "Identity affirmation through 'signature style': A study of toy car designers." Human Relations, 62: 1041–1072.

Elsbach, K. D., and F. J. Flynn
2013 "Creative collaboration and the self-concept: A study of toy designers." Journal of Management Studies, 50: 516–544.

Emirbayer, M.
1997 "Manifesto for a relational sociology." American Journal of Sociology, 103: 281–317.

Everitt, B. S.
1968 "Moments of statistics kappa and weighted kappa." The British Journal of Mathematical and Statistical Psychology, 21: 97–103.

Fine, G. A.
2001 Difficult Reputations: Collective Memories of the Evil, Inept, and Controversial. Chicago, IL: University of Chicago Press.

Fine, G. A., B. Montemurro, B. Semora, M. C. Stalp, D. S. Claussen, and Z. Sierra
1998 "Social order through a prism: Color as collective representation." Sociological Inquiry, 68: 443–457.

Formilan, G.
2021 "Style typologies and competitive advantage." In G. Cattani, S. Ferriani, F. Godart, and S. V. Sgourev (eds.), Aesthetic and Style in Strategy (Advances in Strategic Management, vol. 42): 19–47. Bingley, UK: Emerald Publishing Limited.

Frosh, P.
2003 The Image Factory: Consumer Culture, Photography and the Visual Content Industry. Oxford, UK: Berg.

Fuhse, J. A.
2009 "The meaning structure of social networks." Sociological Theory, 27: 51–73.

Gadamer, H.-G.
1986 The Relevance of the Beautiful and Other Essays. Cambridge, UK: Cambridge University Press.

Gell, A.
1998   Art and Agency: An Anthropological Theory. New York: Oxford University Press.

Godart, F. C.
2018   "Why is style not in fashion? Using the concept of 'style' to understand the creative industries." In C. Jones and M. Maoret (eds.), Frontiers of Creative Industries: Exploring Structural and Categorical Dynamics (Research in the Sociology of Organizations, vol. 55): 103–128. Bingley, UK: Emerald Publishing Limited.

Godart, F. C., and C. Galunic
2019   "Explaining the popularity of cultural elements: Networks, culture, and the structural embeddedness of high fashion trends." Organization Science, 30: 151–168.

Goethe, J. W. von
1840   Theory of Colours. London, UK: John Murray.

Goffman, E.
1963   Stigma: Notes on the Management of Spoiled Identity. Englewood, NJ: Prentice Hall.

Goodman, N.
1978   Ways of Worldmaking. Indianapolis, IN: Hackett Publishing Company.

Graddy, K.
2013   "Taste endures! The rankings of Roger de Piles († 1709) and three centuries of art prices." The Journal of Economic History, 73: 766–791.

Hartigan, J. A., and M. A. Wong
1979   "A K-means clustering algorithm." Applied Statistics, 28: 100–108.

Hebdige, D.
1979   Subculture, the Meaning of Style. London, UK: Routledge.

Hoad, C., and S. Whiting
2017   "True Kvlt? The cultural capital of 'Nordicness' in extreme metal." M/C Journal, 20. DOI.org/10.5204/mcj.1319.

Hudson, B. A.
2008   "Against all odds: A consideration of core-stigmatized organizations." Academy of Management Review, 33: 252–266.

Hudson, B. A., and G. A. Okhuysen
2009   "Not with a ten-foot pole: Core stigma, stigma transfer, and improbable persistence of men's bathhouses." Organization Science, 20: 134–153.

Hunt, R. W. G.
2005   The Reproduction of Colours. New York: John Wiley & Sons.

Isaac, L.
2009   "Movements, aesthetics, and markets in literary change: Making the American labor problem novel." American Sociological Review, 74: 938–965.

Ivanovici, M., R.-M. Coliban, C. Hatfaludi, and I. E. Nicolae
2020   "Color image complexity versus over-segmentation: A preliminary study on the correlation between complexity measures and number of segments." Journal of Imaging, 6: 1–15.

Jones, C., and S. Svejenova
2018   "The architecture of city identity: A multimodal study of Barcelona and Boston." Research in the Sociology of Organizations: Multimodality, Meaning and Institutions, 54B: 203–234.

Kahn-Harris, K.
2006   Extreme Metal: Music and Culture on the Edge. Oxford, UK: Berg.

Kaufman, J.
2004   "Endogenous explanation in the sociology of culture." Annual Review of Sociology, 30: 335–357.

Kress, G., and T. Van Leeuwen
2001   Multimodal Discourse—The Modes and Media of Contemporary Communication. London, UK: Arnold.

Kress, G., and T. Van Leeuwen
2002   "Colour as a semiotic mode: Notes for a grammar of colour." Visual Communication, 1: 343–368.

Labrecque, L. I., V. M. Patrick, and G. R. Milne
2013   "The marketers' prismatic palette: A review of color research and future directions." Psychology and Marketing, 30: 187–202.

Lena, J. C., and R. A. Peterson
2008   "Classification as culture: Types and trajectories of music genres." American Sociological Review, 73: 697–718.

Lieberson, S.
2000   A Matter of Taste: How Names, Fashions, and Culture Change. New Haven, CT: Yale University Press.

Lipovetsky, G., and J. Serroy
2013   L'esthétisation Du Monde. Vivre à l'âge Du Capitalisme Artiste. Paris: Editions Gallimard.

Lobinger, K., and C. Brantner
2019   "Picture-sorting techniques: Card sorting and Q-sort as alternative and complementary approaches in visual social research." In L. Pauwels and D. Mannay (eds.), The Sage Handbook of Visual Research Methods, 2nd ed.: 309–321. London, UK: Sage.

Menke, C.
2013   Force: A Fundamental Concept of Aesthetic Anthropology. New York: Fordham University Press.

Meyer, R. E., M. A. Höllerer, D. Jancsary, and T. Van Leeuwen
2013   "The visual dimension in organizing, organization, and organization research." Academy of Management Annals, 7: 487–553.

Meyers-Levy, J., and R. J. Zhu
2010   "Gender differences in the meanings consumers infer from music and other aesthetic stimuli." Journal of Consumer Psychology, 20: 495–507.

Moynihan, M., and D. Søderlind
1998   Lords of Chaos: The Bloody Rise of the Satanic Metal Underground. Port Townsend, WA: Feral House.

Onians, J.
2007   Neuroarthistory: From Aristotle and Pliny to Baxandall and Zeki. New Haven, CT: Yale University Press.

Pastoureau, M.
2008   Black: The History of a Color. Princeton, NJ: Princeton University Press.

Patterson, D.
2013   Black Metal: Evolution of the Cult. Port Townsend, WA: Feral House.

Phillipov, M.
2012   "Extreme music for extreme people? Norwegian black metal and transcendent violence." Popular Music History, 6: 150–163.

Porter, M. E.
1985   Competitive Advantage. New York: Free Press.

Preston, A. M., C. Wright, and J. J. Young
1996   "Imag[in]ing annual reports." Accounting, Organizations and Society, 21: 113–137.

Rabe-Hesketh, S., and A. Skrondal
2008   Multilevel and Longitudinal Modeling Using Stata. College Station, TX: STATA Press.

Riley, C. A.
1995   Color Codes: Modern Theories of Color in Philosophy, Painting and Architecture, Literature, Music, and Psychology. Hanover, NH: University Press of New England.

Rose-Greenland, F.
2016   "Color perception in sociology: Materiality and authenticity at the *Gods in Color* show." Sociological Theory, 34: 81–105.

Rosi, T., M. Malgieri, P. Onorato, and S. Oss
2016   "What are we looking at when we say magenta? Quantitative measurements of RGB and CMYK colours with a homemade spectrophotometer." European Journal of Physics, 37: 065301.

Ruef, M.
2000   "The emergence of organizational forms: A community ecology approach." American Journal of Sociology, 106: 658–714.

Rydehed, S.
2009   Pure Fucking Mayhem. Zeltingen-Rachtig, Germany: Knife Fight Media.

Sgourev, S. V.
2015   "Brokerage as catalyst: How Diaghilev's Ballets Russes escalated modernism." Organization Studies, 36: 343–361.

Sgourev, S. V.
2021   "Materiality as a basis for valuation entrepreneurship: Re-modeling impressionism." Organization Science, 32: 1235–1255.

Sgourev, S. V., and E. Aadland
2022   "'Burning the bridges': Escalation in the pursuit of authenticity." Theory and Society. https://doi.org/10.1007/s11186-022-09477-1.

Sgourev, S. V., and N. Althuizen
2014   "'Notable' or 'not able': When are acts of inconsistency rewarded?" American Sociological Review, 79: 282–302.

Shannon, C. E.
1948   "A mathematical theory of communication." Bell System Technical Journal, 27: 379–423.

Sherman, G. D., and G. L. Clore
2009   "The color of sin: White and black are perceptual symbols of moral purity and pollution." Psychological Science, 20: 1019–1025.

Shipilov, A., F. C. Godart, and J. Clement
2017   "Which boundaries? How mobility networks across countries and status groups affect the creative performance of organizations." Strategic Management Journal, 38: 1232–1252.

Silk, J.
2013   "Open a vein: Suicidal black metal and enlightenment." Helvete: A Journal of Black Metal Theory, 1: 5–19.

Simmel, G.
1957   "Fashion." American Journal of Sociology, 62: 541–558.

Simmel, G.
1991   "The problem of style." Theory, Culture & Society, 8: 63–71.

Solomon, T.
2005   "'Living underground is tough': Authenticity and locality in the hip-hop community in Istanbul, Turkey." Popular Music, 24: 1–20.

Spence, M.

1973   "Job market signaling." The Quarterly Journal of Economics, 87: 355–374.

Strati, A.
1990   "Aesthetic and organizational skill." In B. A. Turner (ed.), Organizational Symbolism: 207–222. Berlin: Walter de Gruyter.

Strati, A.
2000   "The aesthetic approach in organization studies." In S. Linstead and H. Höpfl (eds.), The Aesthetics of Organization: 13–34. London, UK: Sage.

Suler, J. R., and R. D. Zakia
2018   Perception and Imaging: Photography as a Way of Seeing. New York: Routledge.

Sutton, R. I., and A. L. Callahan
1987   "The stigma of bankruptcy: Spoiled organizational image and its management." Academy of Management Journal, 30: 405–436.

Swidler, A.
2001   Talk of Love: How Culture Matters. Chicago, IL: University of Chicago Press.

Tarde, G.
1897   L'opposition Universelle: Essai d'une Théorie Des Contraires. Paris: Félix Alcan.

Taussig, M.
2009   What Colour Is the Sacred? Chicago, IL: University of Chicago Press.

Tilly, C.
1998   Durable Inequality. Berkeley, CA: University of California Press.

Turner, B. A.
1990   "Introduction." In B. A. Turner (ed.), Organizational Symbolism: 1–11. Berlin: Walter de Gruyter.

Walser, R.
1993   Running with the Devil: Power, Gender, and Madness in Heavy Metal Music. Middletown, CT: Wesleyan University Press.

White, H. C.
1992   Identity and Control: A Structural Theory of Social Action. Networks Vol. 112. Princeton, NJ: Princeton University Press.

Williams, R.
2006   "Generalized ordered logit/partial proportional odds models for ordinal dependent variables." The Stata Journal, 6: 58–82.

Witkin, R. W.
1990   "The collusive manoeuvre: A study of organizational style in work relations." In B. A. Turner (ed.), Organizational Symbolism: 191–205. Berlin: Walter de Gruyter.

Wyszecki, G., and W. S. Stiles

2000   Color Science: Concepts and Methods, Quantitative Data and Formulae, 2nd ed. New York: Wiley Classics Library.

Yaneva, A.
2009   "Making the social hold: Toward an actor-network theory of design." Design Culture, 1: 273–288.

Zarkadi, T., and S. Schnall
2013   "'Black and White' thinking: Visual contrast polarizes moral judgment." Journal of Experimental Social Psychology, 49: 355–359.

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Figure 1. Representative Black Metal and Non-Black Metal Imagery*

* Black metal imagery (clockwise from top left): Darkthrone "A Blaze in the Northern Sky" (album cover); Immortal "Diabolical Fullmoon Mysticism" (album cover); Darkthrone (promo photo); Emperor "Emperor" (album cover); Immortal (promo photo); Emperor (promo photo).

Non-black metal imagery (clockwise from top left): Extol "Burial" (album cover); Conception "Parallel Minds" (album cover); Conception (promo photo); Equinox "Xerox Success" (album cover); Cadaver "Hallucinating Anxiety" (album cover); Equinox (promo photo).

Figure 2. Example of Hue, Saturation, and Luminance Color Representation, with Corresponding RGB Vectors (Discrete Values)
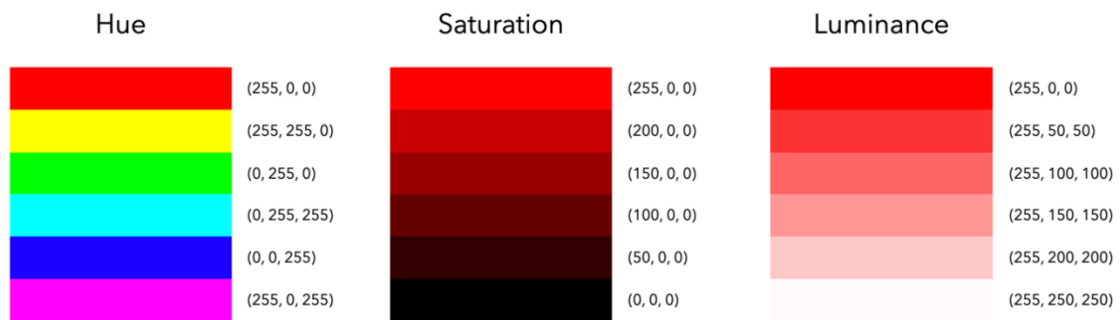
Figure 3. Summary of Data Preparation Routine

[1]	**[2]**	**[3]**	**[output]**
Resize Image to 200x200 px	RGB Components Extraction	K-Means Clustering	Color Clusters

	red	green	blue
1	0.1882353	0.11764706	0.2039216
2	0.1882353	0.11372549	0.2000000
3	0.1882353	0.08627451	0.1843137
4	0.2196078	0.10196078	0.2117647
5	0.2235294	0.09411765	0.2078431
6	0.2235294	0.10196078	0.2235294
7	0.1921569	0.10196078	0.2117647
8	0.1960784	0.11764706	0.2235294
9	0.2039216	0.07450980	0.1803922
10	0.2588235	0.14901961	0.2470588
11	0.2313725	0.13725490	0.2313725

n=40,000 RGB

k=5

Cluster centroids (mean RGB vectors' values) taken as representative colors of the resulting clusters

Figure 4. **Pixel Distribution of High- and Low-Saturation Images (Left) and High- and Low-Contrast Images (Right) in the RGB Space**

Figure 4. **Pixel Distribution of High- and Low-Saturation Images (Left) and High- and Low-Contrast Images (Right) in the RGB Space**

Figure 5. Jitter Plot of Human–Algorithm Agreement on Colorfulness and Contrast

Colorfulness

Consensus on full order: 0.732
Consensus on images' position: 0.790
Weighted Kappa: 0.851

Contrast (Groups)

Consensus on full order: 0.734
Consensus on images' position: 0.779
Weighted Kappa: 0.835

Image position by algorithm

Image position by human perception

Image position by algorithm

Image position by human perception

● Human-Algorithm Agreement
○ Human-Algorithm Disagreement

Figure 6. Image Colorfulness, 1989–2019

Figure 7. Image Contrast, 1989–2019
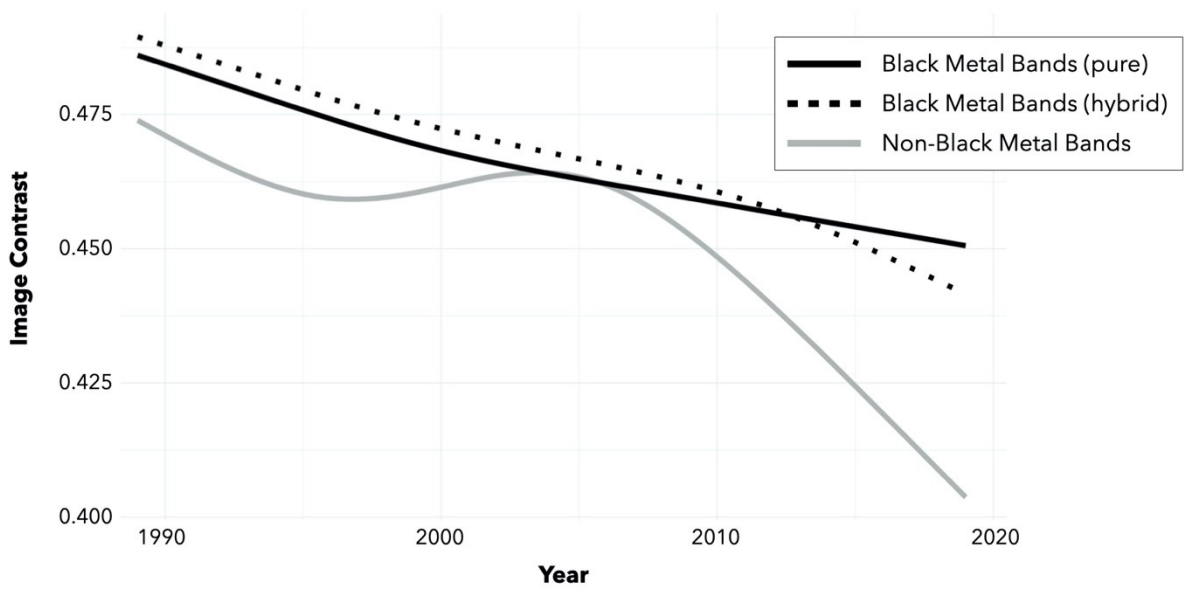
Figure 8. Inverted U-Shaped Effect of Median Colorfulness of Non-Black Metal Cover Image

Predictive Margins with 95% CIs

Table 1. Descriptive Statistics and Correlation Coefficients for the Norwegian Black Metal Cover Image Sample*

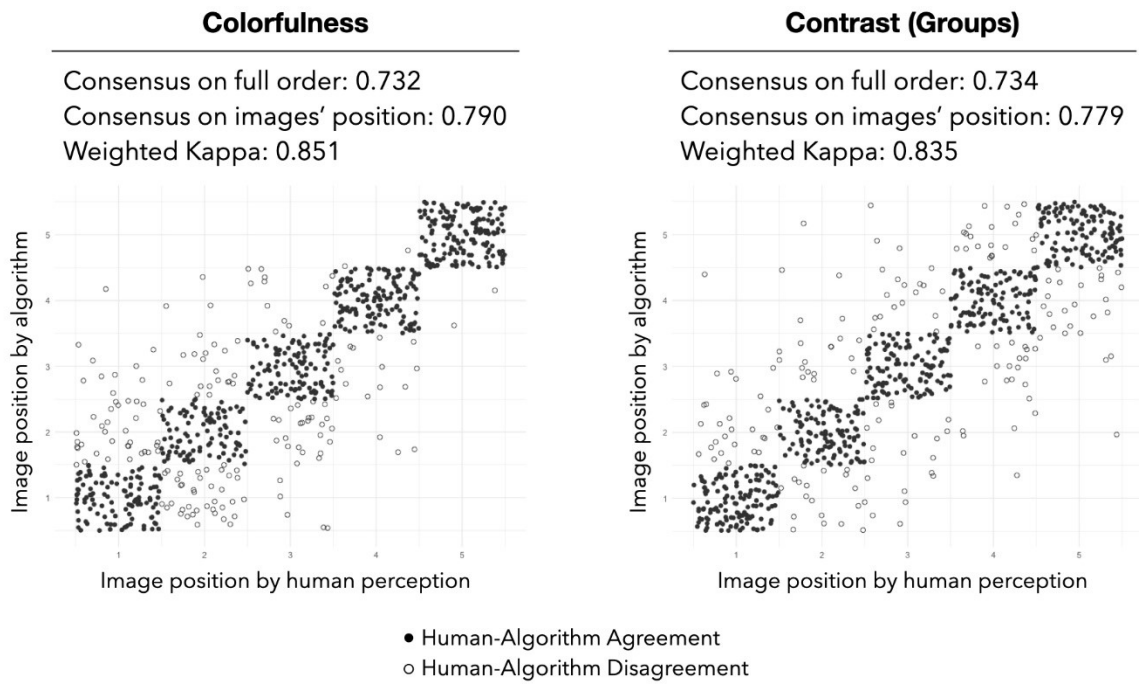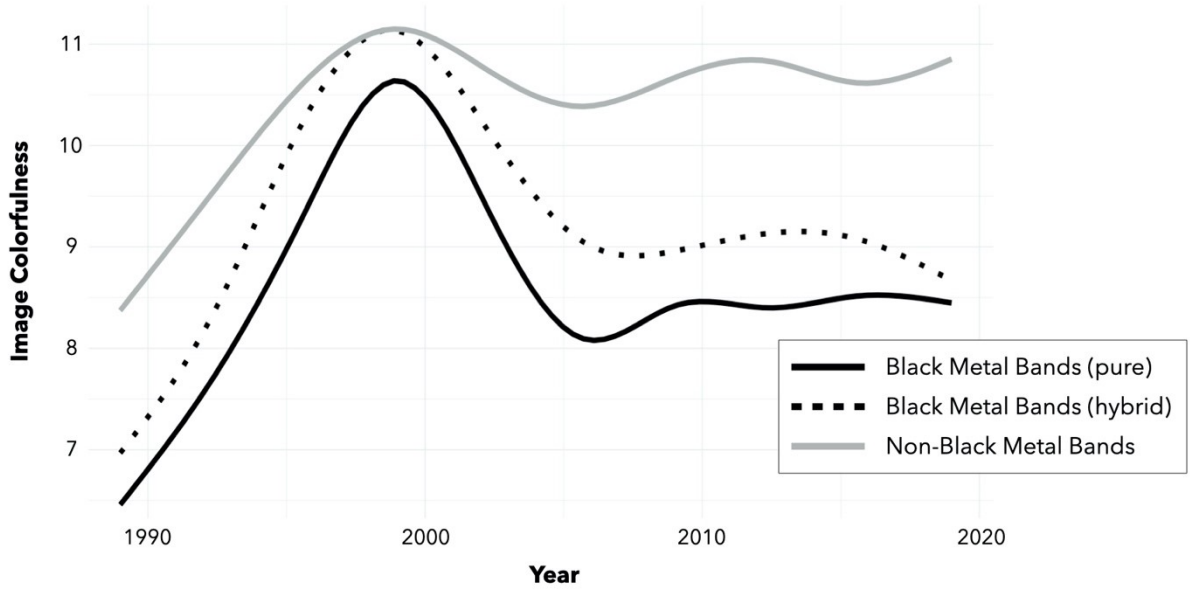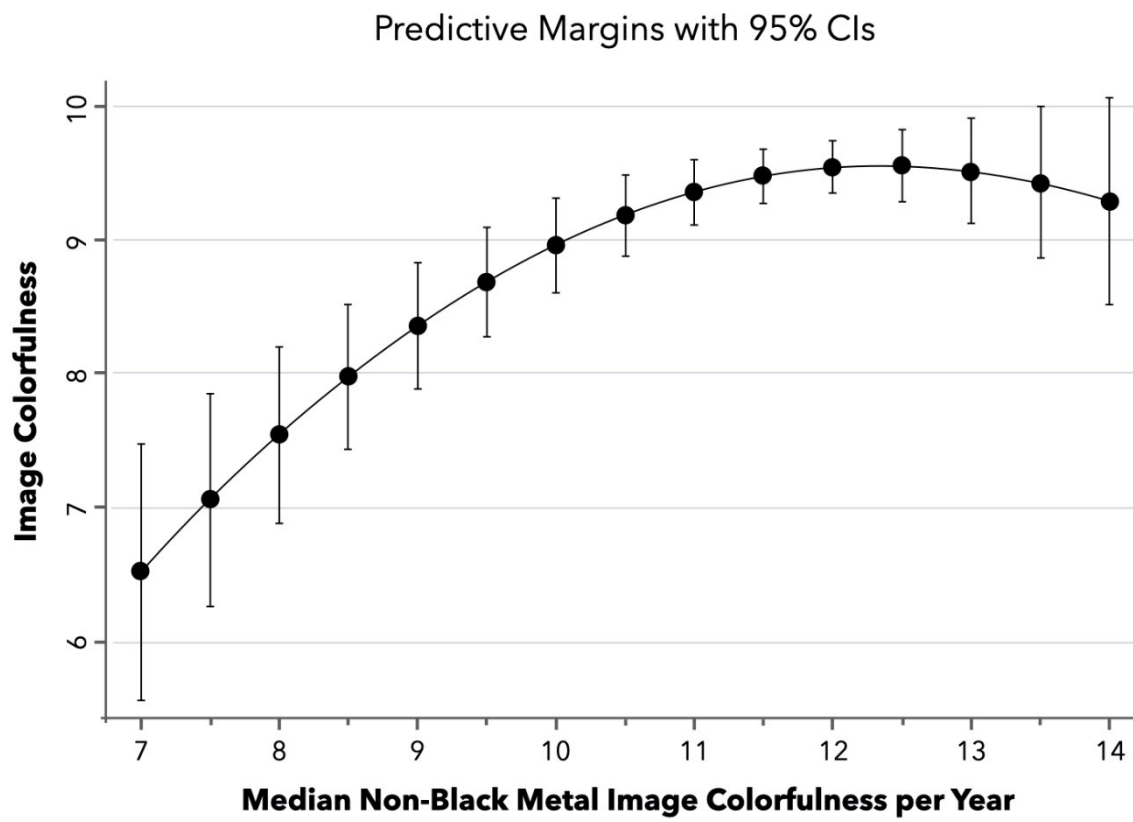|	Mean	S. D.	1	2	3	4	5	6
1. Image colorfulness	9.248	3.523	1					
2. Image contrast	.467	.179	−.21•	1				
3. Band age	6.779	6.642	.103•	−.073•	1			
4. Urban band	.326	.468	−.048•	.023•	−.034•	1		
5. Formed pre-1994	.278	.448	.122•	.027•	.407•	−.022•	1	
6. Demo release	.263	.44	−.194•	.109•	−.387•	−.042•	−.101•	1
7. Black metal band formations outside Norway per year (lag)	1049.63	349.267	−.056•	−.054•	.147•	.001•	−.413•	−.187•
8. Median black metal image colorfulness per year (lag)	9.332	1.487	.129•	−.046•	−.029•	−.034•	−.061•	.030•
9. Median non-black metal image colorfulness per year (lag)	11.518	1.251	.080•	−.104•	.181•	.008	−.357•	−.240•
10. Median black metal image contrast per year (lag)	.473	.03	−.014•	.086•	−.233•	−.018•	.357•	.237•
11. Median non-black metal image contrast per year (lag)	.457	.028	−.045•	.099•	−.242•	−.043•	.223•	.253•
12. News articles stigmatizing Norwegian black metal per year (lag)	1.37	3.146	.037•	.047•	−.124•	.015•	.170•	.072•
13. Number of commercial Norwegian black metal releases per year (lag)	76.653	36.41	−.067•	−.091•	.377•	.037•	−.375•	−.347•
14. Pure black metal band	.538	.498	−.105•	−.010	−.015•	−.053•	−.047•	.039•

	7	8	9	10	11	12	13	14
7. Black metal band formations outside Norway per year (lag)	1							
8. Median black metal image colorfulness per year (lag)	.000	1						
9. Median non-black metal image colorfulness per year (lag)	.542•	.524•	1					
10. Median black metal image contrast per year (lag)	−.510•	−.378•	−.758•	1				
11. Median non-black metal image contrast per year (lag)	−.096•	−.276•	−.423•	.462•	1			
12. News articles stigmatizing Norwegian black metal per year (lag)	−.286•	−.202•	−.416•	.452•	.140•	1		
13. Number of commercial Norwegian black metal releases per year (lag)	.426•	−.063•	.497•	−.599•	−.623•	−.375•	1	
14. Pure black metal band	.030•	.0027	.025•	−.035•	−.021•	−.0111	.046•	1

• $p < .05$.
* N = 2,876

Table 2. Multilevel Mixed-Effects Models of Black Metal Cover Image Colorfulness*

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Band age	−.007	−.019	−.022	−.015	.025	.024	.025
	(.016)	(.016)	(.016)	(.016)	(.019)	(.019)	(.019)
Urban band	−.435•	−.428•	−.436•	−.432•	−.390•	−.417•	−.424•
	(.191)	(.187)	(.188)	(.186)	(.182)	(.181)	(.180)
Formed pre-1994	.581•	.920••	.987•••	.906••	.312	.300	.322
	(.272)	(.281)	(.282)	(.279)	(.320)	(.313)	(.311)
Demo release	−1.626•••	−1.528•••	−1.493•••	−1.498•••	−1.623•••	−1.590•••	−1.549•••
	(.169)	(.168)	(.169)	(.168)	(.171)	(.171)	(.172)
Black metal band formations outside Norway per year (lag)	−.000	−.001••	−.001••	−.001••	−.001••	−.001••	−.001•••
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Median black metal image colorfulness per year (lag)		.152••	.163••	.159••	.109+	.112+	.123•
		(.056)	(.057)	(.056)	(.058)	(.058)	(.059)
Median non-black metal image colorfulness per year (lag)		.265••	1.663•	.314•••	.394•••	.391•••	2.589•••
		(.085)	(.646)	(.088)	(.092)	(.092)	(.647)
Median non-black metal image colorfulness per year (lag)^2			−.067•				−.104•••
			(.031)				(.031)
News articles stigmatizing Norwegian black metal per year (lag)				.061••	.043•	.045•	.048•
				(.020)	(.020)	(.020)	(.020)
Number of commercial Norwegian black metal releases per year (lag)					−.013•••	−.012•••	−.014•••
					(.003)	(.003)	(.003)
Pure black metal band						−.653•••	−.658•••
						(.172)	(.171)
Constant	10.202•••	6.041•••	−1.024	5.265•••	5.818•••	6.134•••	−4.890
	(.318)	(.786)	(3.321)	(.846)	(.853)	(.849)	(3.323)
AIC	15083.15	15036.28	15034.35	15030.14	15016.25	15003.51	14996.21
Observations	2,876	2,876	2,876	2,876	2,876	2,876	2,876
Number of bands	773	773	773	773	773	773	773

+ $p < .10$; • $p < .05$; •• $p < .01$; ••• $p < .001$.

* Robust standard errors are in parentheses, grouping on band.

Table 3. Multilevel Mixed-Effects Models of Black Metal Cover Image Contrast (Groups)*

	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Band age	−.002••	−.001	−.001	−.001	−.001	−.001	−.001
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Urban band	.009	.010	.010	.010	.010	.010	.010
	(.008)	(.008)	(.008)	(.008)	(.008)	(.008)	(.008)
Formed pre-1994	.020+	.006	.006	.006	.010	.010	.009
	(.011)	(.012)	(.012)	(.012)	(.013)	(.013)	(.013)
Demo release	.041•••	.037•••	.037•••	.037•••	.038•••	.039•••	.038•••
	(.009)	(.009)	(.009)	(.009)	(.009)	(.009)	(.009)
Black metal band formations outside Norway per year (lag)	−.000	−.000	−.000	−.000	−.000	−.000	−.000
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Median black metal image contrast per year (lag)		.113	.111	.066	.075	.072	.059
		(.159)	(.159)	(.168)	(.169)	(.169)	(.171)
Median non-black metal image contrast per year (lag)		.330•	−.270	.340•	.389•	.391•	−.760
		(.156)	(2.573)	(.158)	(.173)	(.173)	(2.951)
Median non-black metal image contrast per year (lag)^2			.643				1.228
			(2.710)				(3.105)
News articles stigmatizing Norwegian black metal per year (lag)				.001	.001	.001	.001
				(.001)	(.001)	(.001)	(.001)
Number of commercial Norwegian black metal releases per year (lag)					.000	.000	.000
					(.000)	(.000)	(.000)
Pure black metal band						−.007	−.007
						(.008)	(.008)
Constant	.464•••	.262••	.401	.277••	.242•	.246•	.519
	(.015)	(.090)	(.605)	(.090)	(.103)	(.104)	(.711)
AIC	−1778.518	−1782.513	−1780.567	−1781.267	−1779.749	−1778.528	−1776.692
Observations	2,876	2,876	2,876	2,876	2,876	2,876	2,876
Number of bands	773	773	773	773	773	773	773

+ $p < .10$; • $p < .05$; •• $p < .01$; ••• $p < .001$.

* Robust standard errors are in parentheses, grouping on band.

Online Appendix

Picture-sorting techniques provide a simple, but powerful, way to explore how individuals order a set of visual items (open sorting) or to validate an order defined ex-ante by the researcher (closed sorting; see Lobinger and Brantner, 2019). In designing the survey, we referred to colorfulness as "color complexity," because several pilot tests suggested that this was the most effective way to encourage participants to pay attention not only to the vibrancy of colors ("saturation") but also their distribution in the image ("entropy").

We had two principal reasons to select 5 images. First, based on a visual inspection of the distribution of *Image Colorfulness* and *Image Contrast* in our data, we concluded that a higher number of items was attenuating the magnitude of the differences between the images. Second, we wanted to ensure that the survey could be completed on a smartphone. Because of limitations of the software that we used to design the survey, a sequence of more-than-five images may not have been displayed correctly on phone screens. After we collected the results, we recoded our algorithmic measures into 5, 4, and 3 quantiles, subjecting them to a regression analysis that confirmed that the results are robust to a less fine-grained measure of colorfulness and contrast.

Image selection

To select the images for the image-sorting task, we first organized all images in the data into ordered categories based on the mean (+/- 0.045) of the two focal variables' empirical quintiles. This produced 25 groups of images with distinct (not overlapping and not borderline) color properties along one or both of the dimensions, colorfulness and contrast. We then selected one representative image per group and organized them in a 5x5 matrix, where the x-axis represented contrast and the y-axis colorfulness (Figure A1).

Figure A1. Matrix showing 25 images arranged by contrast and colorfulness.

In determining which images to use in the sorting task, we tried to maximize the difference between the two empirical orderings along the relevant dimensions. To that end, the selection process had to fulfill three conditions: 1) each dimension's quintile could not occur twice; 2) the ordering of the images could not be the same on the two dimensions; and 3) the two images' orderings could not be the inverse of one another.

This led to four possible sets of images, according to 5x5 matrix transposition. We selected the images in the first transposition (0°) because those 1) were the most distinctive

from one another when processed into shades of grey for the contrast-focused task, and 2) had a common base color composition (similar color wavelength frequency, between green and red).

We created three measures for the colorfulness- and contrast-based tasks: respondents' consensus over the full order of the images (*Formula A*) and over the position of each image in the order (*Formula B*); and Cohen's weighted kappa statistic of inter-rater agreement (Everitt, 1968; *Formula C*). Mathematically,

$$Consensus_{order} = 1 - \frac{\text{mean}(D)}{\text{max}(D)} \qquad (Formula\ A)$$

where *D* is the upper triangle of the matrix featuring the pairwise Euclidean distances between each respondent's orderings. We calculated the pairwise Euclidean distances using social sequence analysis techniques (see Formilan, Ferriani, and Cattani, 2020) with substitution costs given by the transition rate between each item's position in the experimental data and indel cost set at the standard value of 2.

$$Consensus_{position} = \frac{1}{P}\sum_{p=1}^{P}\frac{\text{max}(C_p)}{P} (Formula\ B)$$

where *P* is the total number of items in the ordering and C_p is the count of each item assigned to position *p*.

$$Kappa_{weighted} = 1 - \frac{\sum_{i,j} p_{ij}\, w_{ij}}{\sum_{i,j} e_{ij}\, w_{ij}} \qquad (Formula\ C)$$

where *i* and *j* identify the position of each element in the human-algorithm cross-tabulation matrix, p_{ij} are the observed values, e_{ij} are the expected values, and w_{ij} are the (linear) weights assigned to each value, computed for 5 images as |*i-j*|/4. Each measure takes value from 0 to 1; kappa values above 0.8 attest for highly substantial agreement.

References

Everitt, B. S.
1968 "Moments of statistics kappa and weighted kappa." The British Journal of Mathematical and Statistical Psychology, 21: 97–103.

Formilan, G., S. Ferriani, and G. Cattani
2020   "A methodological essay on the application of social sequence analysis to the study of creative trajectories." In V. Döfler and M. Stierand (eds.), Handbook of Research Methods on Creativity: 329–350. Cheltenham, UK: Edward Elgar Publishing.

Lobinger, K., and C. Brantner
2019   "Picture-sorting techniques: Card sorting and Q-sort as alternative and complementary approaches in visual social research." In L. Pauwels and D. Mannay (eds.), The Sage Handbook of Visual Research Methods, 2nd ed.: 309–321. London, UK: Sage.