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The Value of Arts-Based Methods in STEM: Formal Analysis, Open Dialogue, and Subjectivity

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Article abstract

In the Fall of 2021, STEM researchers were invited to participate in a series of SSHRC-funded workshops delivered at the University of Guelph's School of Fine Art and Music (SOFAM), where they examined a work of abstract art drawn from the SOFAM Print Study Collection (*Reflex Victory* by Chrysanne Stathacos, lithograph, 1979). The project's objective was to determine if methodologies used in the analysis and interpretation of art are helpful to researchers who use visual observation as a primary method of collecting data. Our findings indicate that over the duration of the one-hour workshop, participants demonstrated greater confidence in identifying what lay in their fields of vision with precision, exhibited greater comfort in pursuing open-ended inquiry, and became more conscious of the mutable and subjective qualities of their looking. This report shares the story of our experiment and presents our preliminary findings on the value of arts-based methodologies in developing skills in data collection and analysis. This research contributes to the discourse on the role visual art can play in practices of teaching, learning, and research that extend beyond the studio, museum, and gallery space.

The Value of Arts-Based Methods in STEM: Formal Analysis, Open Dialogue, and Subjectivity

By Christina Smylitopoulos, Sarah Mousseau, and with Nakita Byrne-Mamahit, Sarah Oatley, Anna Sutton

In the Fall of 2021, STEM researchers were invited to participate in a series of SSHRC-funded workshops delivered at the University of Guelph's School of Fine Art and Music (SOFAM), where they examined a work of abstract art drawn from the SOFAM Print Study Collection (*Reflex Victory* by Chrysanne Stathacos, lithograph, 1979). The project's objective was to determine if methodologies used in the analysis and interpretation of art are helpful to researchers who use visual observation as a primary method of collecting data. Our findings indicate that over the duration of the one-hour workshop, participants demonstrated greater confidence in identifying what lay in their fields of vision with precision, exhibited greater comfort in pursuing open-ended inquiry, and became more conscious of the mutable and subjective qualities of their looking. This report shares the story of our experiment and presents our preliminary findings on the value of arts-based methodologies in developing skills in data collection and analysis. This research contributes to the discourse on the role visual art can play in practices of teaching, learning, and research that extend beyond the studio, museum, and gallery space.

Keywords: *STEAM, Arts-Based Research, Critical Visuality, Visual Priority, Interdisciplinary/ Transdisciplinary Pedagogy*

> "A deeper understanding of what enters my field of view has radically altered how I look at the things around me and how I take in visual data." (Workshop participant follow-up questionnaire response)

Christina Smylitopoulos

Dr Christina Smylitopoulos (Associate Professor, School of Fine Art and Music) is an award-winning researcher at the University of Guelph and Director-Curator of the SOFAM Print Study Collection. She received the UGFA Distinguished Professor Award for Teaching Excellence (2019), the College of Arts Teaching Excellence Award (2014), and was named Post-Secondary Art Educator of the Year (2023-24) by the Ontario Art Education Association for her work on the pedagogical capacities of arts-based methodologies.

Sarah Mousseau

Sarah Mousseau recently graduated from the University of Guelph with an MA in Art History and Visual Culture. She was awarded a SSHRC CGS-M and an Ontario Graduate Scholarship for her research examining the development of identity-based narratives and alcohol consumption in British and settler-colonial visual culture. She is starting her PhD in Art History at McGill University in the fall of 2024. Sarah enjoys spending time in creative pursuits including printmaking, painting, and collage.

Introduction

Researchers are looking to arts-based methodologies to investigate and interpret the objects of their analysis more expansively. Their aim is to galvanize deeper understanding and encourage innovation in scientific inquiry through creative practice ("art as research"), arts-driven critical appraisal and dissemination ("art in research"), and the contributions to knowledge made by aesthetic discourses ("research about art") (Wang et al., 2017, p. 14). A review of the literature reveals that scholars concerned with human health and interaction—between people (Lev, 2020), objects (Groot & Abma, 2021), and the environment (Muhr, 2020)—have demonstrated leadership in employing arts-based research (ABR) to address their questions. In the last 15 years, there has been an uptick in studies that use ABR, despite being at one time an "unsellable commodity" in the social sciences (Seifert, 2009, p. 2). Innovators seeking diverse epistemologies have highlighted ABR's potential for articulating knowledge that is difficult to express (Rice et al., 2021), is inexpressible by any other means (Barone & Eisner, 2012), or arrives at human consciousness through emotion and intuition (Adams & Owens, 2021). Researchers are also seeing the potential of ABR to present findings in ways that are more accessible to people in, across, and outside the academy (Leavy, 2015).

The STEAM (science, technology, engineering, art, and math) education movement, which surfaces the value of art in STEM (science,

technology, engineering, and math) initiatives, has similarly gained momentum and suggests a growing terrain wherein arts-based practices are viewed as solutions to pedagogical challenges and can inform the research enterprise from inspiration to conceptualization, execution, reflection, and beyond (Sousa & Pilecki, 2018). This movement is in part a response to concerns about the decline of student aptitudes in STEM

Figure 1. Research Team Facilitators and Participants in the Nexus for Innovation Workshop, University of Guelph, 2019

despite significant investment in these pedagogical initiatives. STEAM approaches underscore the importance of skills and competencies acquired in arts disciplines that might include collaborative practice, arts-based design methodologies, communication, data visualization, and out-of-the-box thinking - to name only a few. The movement also draws attention to the persistence of "branch disciplines" or silos that result in "little room for teachers to promote reality-based, inter-connected learning" (Yakman, 2006, p. 4). Although declining arts instruction in teacher training has challenged the feasibility of STEAM approaches (Campbell, 2022), the potential for the skills acquired in the arts to constructively inform scientific inquiry remains. What the ABR and STEAM movements appear to have in common is the notion that the orthodox paradigm, which Barone and Eisner tell us is "the experiment" (2012, p. x), is but one of a range of approaches that can be productively applied to address teaching, learning, and research questions.

Our research team—based in the School of Fine Art and Music (SOFAM) at the University of Guelph—has taken another route by developing an experiment that uses more traditional scientific approaches to underscore the value of arts-based methods of analysis and interpretation. In doing so, we contribute to the evolving understanding of ABR by advancing slow and deliberate engagement with art as a research practice. Formal analysis—a fundamental component of artistic training/ practice and a constructive method to examine the products of artistic expression critically—is a methodology that encourages deeper understanding of the complex and socio-culturally constructed nature of visuality and provides tools to help identify and consider the

impact of positionalities on research. As researchers who are trained in the study/practice of art/ artmaking, we have also expanded our own tool kits by exploring other methods by which to gain and share knowledge. Within the vast territory wherein art and science can and do coexist, an important shared competency is close visual examination, one of a host of sensorial methods of knowing that can help researchers to gain valuable insights.

Building on the groundbreaking work by art historians, museum educators, and their project partners—including Bardes, Gillers, and Herman (2001); Friedlaender (2013, 2020, 2022); Zazulak and Knibb (2021); Le Gall (2017, 2021); and others—the team developed the project through multiple consultations. We held discussions with individuals and research teams, along with a two-day multi-disciplinary study event (Nexus for Innovation: Extended Practices of Art Collections, University of Guelph, June 5 – 6, 2019) that brought together researchers in STEM, the arts, and curators of collections of rare books, fine art, fashion history, and the history of veterinary medicine. We argued that collections are profound research environments, and our objective was to investigate the potential for using galleries and museums as sources for knowledge-building techniques. These activities were funded through an Early Researcher Award from the Ontario Ministry of Research, Innovation, and Science and grants from the Social Science and Humanities Research Council of Canada (Connection/Insight) and has resulted in a series of conversations that, owing to disciplinary siloing in research and research training, may not have happened otherwise.

In the Fall of 2021, STEM researchers were invited to participate in a series of workshops delivered at the University of Guelph, where they examined a work of abstract art drawn from the SOFAM Print Study Collection (PSC). Initially developed to provide studio art students with examples of fine art prints from a range of historical periods and technological processes, the PSC has recently become a hub of inter-disciplinary teaching, learning, and research. The goal of these workshops was to provide participants with skills to help them become more conscious of the mutable and subjective qualities of their looking, to provide tools to better identify and record visual findings, and to determine if the interpretive methodologies implicated in the visual analysis of art is helpful to researchers who use visual observation as a primary method of collecting data. While drawing attention to the role of subjectivity in visual observation was the crux of our goal, our assignment as an interdisciplinary partner was to engage with the practical work experience of STEM-based researchers studying everything from data to plants and animals, and so we limited our discussion of "vision" or "sight" to more tangible aspects of looking. Our experiment, which was conducted by a

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Nakita Byrne-Mamahit is a Project Coordinator at the University of Guelph's Research Innovation Office, focusing on Commercialization Outcomes. With a background in B.A. English and Art History and an M.A. in Art History and Visual Culture from the University of Guelph, she promotes University intellectual property. Nakita leverages her experience from visual competencies workshops to bridge gaps in effectively communicating and distributing research-generated intellectual property to the public.

Sarah Oatley

Sarah Oatley is a future educator who advocates for the integration of arts-based methodologies into STEM. She has conducted material and archival research in several Canadian collections and contributed to various exhibitions of fashion, art, and history. Earning her M.A. in Art History and Visual Culture at the University of Guelph, Sarah is interested in the relationships between art, craft, and identity and incorporates materiality into her lessons through object-based learning.

Anna Sutton

Anna Sutton worked as an undergraduate research assistant to Dr Christina Smylitopoulos at the University of Guelph. During this time, she worked on the study "Building a Laboratory of Visual Competencies: Interdisciplinary Critical Appraisal and Observational Practice" and organized the "Nexus for Innovation: Extended practices of Art Collections" international workshop. A true champion of STEAM, Anna completed her Bachelor of Arts degree in Art History at the University of Guelph and is now pursuing a doctorate degree in naturopathic medicine.

Figure 2. SOFAM Print Study Collection, Zavitz Hall, University of Guelph

team comprised of SOFAM undergraduate and graduate students led by a faculty art historian/curator, embraces a wider definition of STEM in alignment with the US National Science Foundation that includes business and the social sciences (Gonzalez & Kuenzi, 2012). Our workshops were designed to examine methods of visual interrogation, an expanded understanding of researcher bias, the potential for interdisciplinary common ground, and ways to expand the toolkits of both arts and STEM researchers.

Methods

This research design employs a mixed-method approach that includes in-person interventional workshops (2-4 participants and 2 session facilitators each), group discussions, paper questionnaires, and an online questionnaire sent out to participants one year following the event. The work of art we asked our workshop participants to analyse is a lithograph by the multidisciplinary and multi-award winning Canadian-American feminist artist and educator, Chrysanne Stathacos, entitled *Reflex Victory (1979)*, a work that was selected on the basis of its dynamic composition, abstract nature, and the breadth of formal qualities it reflects. Our first aim was to create a welcoming and judgement-free laboratory where the non-arts researcher participants could learn and practice arts-based methods of observation in a congenial setting. A room in the School of Fine Art and Music, now known as the Visual Competencies Lab, was fitted with small individual tables and chairs, an art rack to hang framed works of art, and a whiteboard to record group discussion responses.

Although the study was originally designed to reflect a less formal mode of interaction with the work of art, which is a style more reflective of the type of encounters we created for participants of the Nexus for Innovation workshop, the research unfolded during the COVID-19 pandemic. University and local health authority social distancing policies and the size/shape of the room determined the placement of both the participants and the facilitators, effectively limiting their movements. However, participants were invited to examine the work more closely on an individual basis and photographic details were created to collapse the space between the participant and the work's 2-dimensional qualities. To further undermine the formality of the imposed design, and the power dynamics implicated in these configurations, student facilitators reinforced the open nature of the workshop and encouraged participants to approach the exercises in whatever ways they wished. These strategies helped to reduce the impact of these restrictions. The research team delivered 7 workshops that engaged with 20 participants in total, 85% (n=17) of whom identified as STEM researchers. These workshops were audio recorded and these recordings were subsequently transcribed for analysis.

At the start of each workshop, participants were seated and the Stathacos print unveiled. Participants were given 5 minutes to study the print and respond to a written questionnaire asking them to identify the aspect of the work they were first drawn to and to identify and record their main discipline(s) of study. Using the questionnaire answers as icebreakers, the team initiated a discussion and asked participants to elaborate on what they prioritized in their looking. This challenged the participants to become more conscious of what they privileged in their fields of view and to begin exploring possible reasons why they prioritized some elements over others. We observed a trend in the responses that this line of inquiry often culminated in a discussion about how participants' scientific research interests led them to draw certain conclusions about the work of art. For example, one participant, whose research involved studying wheat plants for signs of disease, described a specific shade of green used in the Stathacos print as "not one [they] typically like" because in their field it signifies an "unhealthy" plant.

In the workshop, these initial discussions were followed by an exercise in identifying colour, line, shape, form, tone, texture, and

**Figure 3. Chrysanne Stathacos, *Reflex Victory*, 1979. Lithograph, Artist Proof, 1/1, 99.57 x 75.69 cm.
SOFAM Print Study Collection, University of Guelph, UG1998.012.070**

pattern (space/arrangement) at which point we distributed a chart including examples of basic terms describing formal qualities, a step in the research plan that was added following a workshop practice session. This intervention, and the reasons why it was made, will be explored in greater detail in the next section. Participants were then shown a printed copy of an enlarged detail of one section of the lithograph—our creative solution to the COVID-19 regulations that prevented our participants from moving about the room freely—and were asked to consider if any of their initial observations had changed once closer study had been conducted. Participants completed a second questionnaire that asked them to share if they had, over the course of their studies, received any training in visual observation and been provided with opportunities to develop an understanding of subjectivity and its (dis)advantages to data collection. We aimed to gain a deeper understanding of the methods and approaches employed by our STEM colleagues and, in the process, became more conscious of our own.

Preliminary Results

Participants expressed excitement about participating in the study. We learned that the workshop was, for many who attended, the first time they had ever been invited to take part in an arts-related event on campus.

An early finding of the research was that, despite their enthusiasm, many of our STEM participants became anxious when they learned they would be discussing the formal qualities of a work of art. Participants were assured and reassured that there were no incorrect answers to the questions we posed, a condition of the workshop some of our STEM participants found challenging despite our efforts to provide a comfortable space for sharing. In the workshop records (audio recordings/transcriptions), the evidence of their apprehension manifested in STEM participants backtracking after making genuinely insightful observations. For example, following a contribution to the discussion, one participant dismissed their previous comments by stating that they "didn't know what [they were] talking about", while another declared that they were "probably wrong". Many of our STEM participants seemed to find confidence in discussing what was most accessible to them. Colour, for instance, seemed to be a kind of inter-disciplinary common ground. One participant summed it up nicely by stating that they were first drawn to the "intense colours…[because] I think … I'm a little uncomfortable, this is a new situation for me, so I'm like… colour! Something I can grab onto!".

Figure 4. Research Team Members Facilitating Workshop

Although we expected STEM participants might not be familiar with art-specific terminology, a suspicion confirmed most frequently by subjects describing the print as a "painting" or "photograph," our transcripts reveal an assumption common to many who attended— namely, that the work was created by the artist "at random". Once participants slowed their looking and were given new language to describe the individual elements of the print, our participants began to remark on the layered effect of line and colour that led to more complex descriptions of what they observed. Participants also asked a series of questions regarding the planographic processes used in making lithographic prints along with queries concerning the artist's creative intention. In some cases, this technical knowledge changed their opinion of the work. This new awareness of method, arrived at through formal analysis, enabled

participants to develop a deeper appreciation for the piece: "I like it more now, because when you unveiled it, I was like, oh, I could do that. But now I see it's more intricate than I thought".

Emphasizing formal qualities in the workshops also helped participants to explore the limitations of symbolic descriptive devices. For example, one participant identified a shape and described it as being like the "letter M." This use of a simile was quickly questioned by another participant, who asked: "How do you know it's not a W?" In this example, a third participant interjected: "It could be a mountain". The reliance on symbols or identifiable objects to explain what they were addressing in a non-representational work of art became a key topic in our research team's post-workshop discussions. Early in the research project, and in response to their discomfort, we decided to provide our participants with a chart that included a range of terms that could be used to describe and modify formal qualities. We were fascinated by the varied responses this aid inspired. Although the terms we included in this chart are not exclusive to the study of art— examples of general descriptive terms include words such as thick, thin, horizontal, and vertical— the list seemed to empower participants to expound on their initial observations by using the terms to provide greater specificity. Others used the aid as a checklist and, in one case, a participant treated the chart like a word-search game and set about identifying examples of each term within the piece. Two participants marked the adjectives in the chart that they determined applied to the work, one of whom limited their choices to a single quality from each column. For example, for colour, the participant selected "Polychromatic"; shape: "Irregular"; form: "Sharp"; tone: "Contrasting"; texture: "Coarse"; pattern: "Spiraling", while line was skipped. This suggests that the participant may have thought that only one adjective should apply and that they were required to judge which one was most relevant. Another participant explained that they had not yet "discovered the vertical and horizontal" lines described in the chart but could see everything else.

As a project focused on understanding how and where arts-based methodologies can be productive in developing competencies in observation, our workshops revealed that participants who did not have training or experience in examining and interpreting works of visual art often dismissed their own observations, even before they had been communicated fully. This we learned was because they were either afraid their answers would be "incorrect" or could not communicate them in a way that reflected the complexity of what they observed, and so retreated from the

discussion, sometimes altogether. In a comment the team found particularly helpful, one of our STEM participants explained that the behaviours recounted above relate to the inclination to "find the truth" and seek the "right answer", an approach the group described as being ingrained as a foundational principle in STEM disciplines. But as the workshop unfolded, participants seemed to embrace what we offered in the discussion and even expanded their observations to include emotional responses to the work. They also highlighted aspects of the piece that triggered memories and even began to speculate on the artist's creative intentions. Ultimately, our findings indicate that, over the duration of the one-hour workshop, STEM participants became more confident in identifying what lay in their fields of vision with precision and more comfortable pursuing open-ended, even speculative inquiry.

Figure 5. Research Team Members Facilitating Workshop

Perhaps most remarkably, we learned that STEM participants felt that subjectivity in looking could pose a barrier, or was something to "reduce" or "avoid" when collecting and calibrating data across time and across researchers, yet of the 70% (n=14) of workshop participants who responded to the questionnaire that addressed this aspect of the research, only half (n=7) had received any training in visual observation or been urged to develop an understanding of subjectivity and its relationship to unconscious bias. Indeed, the absence of experience with the concept of subjectivity compelled the team to simplify its complexity by using a broad definition provided by the Oxford English Dictionary. In the context of the workshop, subjectivity was explored as "the quality or the condition of viewing things chiefly or exclusively through the medium of one's own mind or individuality" and "the condition of being dominated by or absorbed in one's own personal feelings, thoughts, concerns." Those trained in conducting visual analysis on art would not be surprised to learn that a group of people would privilege different formal aspects of the same object of analysis, nor that a single person may privilege different formal aspects of the same work of art over time. Subjectivity can affect the quality of data collected through visual observation in significant and, too often, unexamined ways. When asked if they had training regarding

subjectivity in their looking, one workshop participant replied: "Unfortunately, no. However, I believe that this knowledge is essential for the people who study biology". For those who were provided with opportunities to explore subjectivity in their training, 43% (n=3) identified as having arts/humanities instruction, while another 43% (n=3) had in the context of their STEM training discussed subjectivity as something to be reduced or avoided altogether. One participant even discussed the reliance upon computers to "quantify" visual data and suggested that a deeper understanding of subjectivity would help when "automated processes are not available". Of these respondents, only one participant reported that subjectivity was discussed as being potentially "useful". We wondered if arts-based practices could help STEM trainees to develop a more complicated understanding of subjectivities, the way they operate, and even their potential value to research.

We were encouraged when of the 20 researchers who attended the workshops, 60% (n=12) participated in the one-year follow-up questionnaire. The team was delighted to learn that 80% (n=10) of these respondents expressed that they found the workshop to be helpful, particularly with respect to sharpening their understanding of subjectivity in observational practice and what might inform subjectivities, more broadly. In the words of one participant, "the factors that affect that subjectivity haven't always been something I have considered." As we continue to refine our experiment, we are keen to see what more we can learn. In the meantime, we are confident that the open dialogue that art can inspire can help to create an environment where everyone can grow their skills and aptitudes and gain a deeper understanding of the place these competencies occupy in the research enterprise.

**Confusion in the Face of 'Chaos'.
Closing Thoughts by Sarah Mousseau**

Much of the workshop was designed to help participants see and describe the formal qualities of the print, which is something that most of them have never done before. In fact, only three out of twenty participants declared they had formal postsecondary arts training. Within the first few sessions, it quickly became apparent that the majority of the participants were uncomfortable describing the materiality of the work and chose instead to engage with it on an emotional level. This surprised us because our STEM participants came from a number of disciplines that relied heavily upon visual observation. In fact, the workshop had been inspired by a conversation between Dr. Smylitopoulos and a member of the Ontario

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Agricultural College about using an arts-based intervention to, in a sense, "calibrate" the visual observations gathered by the College's graduate students. In addition, we were familiar with hosting groups of school-aged children who engage with the formal qualities of a given work of art with gusto and readily offer up unique observations, uninhibited. Ultimately, what we had taken for granted was that our STEM participants would easily adapt their techniques in visual observation practiced in the field or science lab to the environment of the Visual Competencies Lab which would then enable us to spend more time unpacking the concepts of visual priority and bias as a group.

What we observed, instead, was that when the work of art was revealed, participants were hesitant to share their thoughts and they struggled to find the language to express themselves. They often relied on physical gestures (like pointing) to communicate. Ideas were presented in a tentative way through the use of phrases like "sort of" and "kind of like." These expressions and similar variations occurred in all seven sessions held over a three-month period in 2021. As one participant noted: "this is challenging… for the way we think. " Many described feeling overwhelmed or used language that suggested an overwhelming sensation—words like intense, madness, frenzy, stressful, and even "hot mess". The word "chaos" in particular came up in all seven sessions. For example, one participant described being drawn to "the pink trapezoidal shape because it's an actual structure within… madness ," while another participant said the print represented to them a "chaotic joy." The uncertainty present in these early observations was unexpected but not un-welcome. We believe that the discomfort we were witnessing in our participants was their struggle to reconcile a new experience with their own prior knowledge—in short, they were confused. So, it wasn't just that the print itself was unfamiliar to participants, but also that the process of engaging with art in a critical way was a novel experience. What we think we were encountering was confusion interfering in the participants' ability to connect with the print's materiality because their understanding of art is based primarily on art's connection to emotion, or how it makes them feel. In fact, a number of participants linked their observations of "chaos" and "stress" to how they were feeling, personally. What we needed was to find a way to guide our STEM-based researchers through the discomfort of confusion so that we could reach our goal as a group within our self-imposed time limit of one hour.

The overwhelming sense of confusion about the print itself, and the task of engaging with it on a material level, meant that we had to adjust our approach to make some space for participants to feel vulnerable in their uncertainty. We managed this through ongoing positive reinforcement and affirmation that participants' ideas were both valid and valued. The reasons for this fear are beyond the scope of this paper, however it is important to state that the creation of a safe and positive environment for participants to freely discuss art was integral to building participant confidence and maintaining their interest and engagement with a challenging work of art. The patience and persistence of everyone in the lab to cultivate this safe space enables participants to unravel their confusion and become curious.

Moving from Confusion to Curiosity

It is a sign of the courage of our participants that while they could leave at any time, they consistently chose to remain and wade through their discomfort together. Over the course of each session, we witnessed a shift in the level of interest participants took in the print, as well as in their confidence in discussing its materiality. For example, while participants were restricted from directly interacting with the print physically, many used their imaginations to speculate about how the pigment on the paper would feel to the touch, and they also provided hypotheses about the artist's methodology including the types of materials involved and the physical acts of applying the pigment to the stone. The more time the workshop groups spent looking at and discussing *Reflex Victory*, the more interested they became in the work, demonstrating an increase in curiosity. They often made connections with the formal qualities of the print by applying techniques from their own research in a unique way that is not necessarily conventional in art education. Openly describing their process, some participants "read" the print as statistical information—even going so far as to describe the print as "data" on one occasion, saying: "because of the sheer intensity of the rest of the data, [the lower pink section] would be ignored, basically." Shapes within the work were sometimes interpreted as alpha-numeric characters, bacteria, and amoebas based on the participants' unique perspectives as STEM-based researchers. Other participants connected colours with their own experience, like the green shade of an unhealthy plant or the mauve of a dyed onion skin seen through a microscope. Likening the red pigment in the print to blood was a common connection.

"Many described feeling overwhelmed or used language that suggested an overwhelming sensation— words like intense, madness, frenzy, stressful, and even "hot mess". The word "chaos" in particular came up in all seven sessions"

Perhaps the most unusual observation was a series of "sea creatures" detected by one participant who insisted they were a deliberate inclusion by the artist. They explained to the group that as a data analyst, given long enough, they could decipher the meaning of the work through these patterns. This is perhaps an example of illusory pattern perception, which occurs when patterns and images are perceived where they don't exist in reality (Whitson & Galinsky, 2008). This is often experienced when a person feels a loss of control, so it is understandable that workshop participants would look to pattern-seeking as a way of unravelling their confusion—especially for those who spend their time studying data for patterns. In the absence of clear representational form, it could even be used to create a narrative. For example, one participant described seeing an author as they imagine, organize, and then write their thoughts down onto paper. Other illusory observations include a flower, a butterfly, and a hummingbird. Viewing the print as an optical illusion, these participants seem to connect the non-representational gestures in the composition with familiar imagery as they try to reconcile the incoming visual information. While these techniques are unusual, they demonstrate an increased level of interest and offer a deeper level of engagement for workshop participants to work through the discomfort of confusion in order to assign meaning to the artwork that has relevance to them.

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