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### A New Method for Analyzing Data From Visual Artwork

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# A New Method for Analyzing Data From Visual Artwork

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## ABSTRACT

This article presents a novel data analytic approach to collect detailed information from visual artworks. This new method provides researchers with a framework to compare, analyze, and review in a systematic way large quantities of data from visual productions. Drawing on principles of art historical criticism, our research team devised a comprehensive coding scheme that captures both technical and content attributes. The coding scheme is configured to record specific, fundamental features for each artwork, providing an instrument for collecting data and cross-examining codes to reveal content in a unique and unbiased manner. For example, detailed data collected through individual codes can reveal clear patterns in the artistic treatment of composition and medium, providing evidence that the method could be adapted and applied for use in a variety of settings. To illustrate the method, this article presents examples from an empirical research study that was conducted at Harvard University's Project Zero. In this study, the coding scheme was applied to 414 pieces of artwork published in a teen art and literary magazine between 1990 and 2011. The coding scheme is defined and applied to 2 sample artworks, allowing readers to understand how this method can be used to record nuanced information about each work. Applying this analytic approach to visual art created in museums and informal learning settings can yield insights into artworks, their creators, and nuanced changes in creative production over time.

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The purpose of this article is to introduce an innovative approach designed to collect, record, and analyze data about visual artwork. This approach will be useful to museums and informal learning institutions as a tool to assess and evaluate artworks created during programs associated with exhibitions and collections. Producing artwork, both casual and complex, as part of the informal learning experience at museums, can increase visitor engagement. Immersive sensory experiences promote

visitors' connection with exhibition content (Falk & Dierking, 2000). A challenge for the research and evaluation teams within these institutions is that a framework for analysis of visual works is not universally established (Kress & van Leeuwen, 2006). We offer this method as a way to capture detailed data from an unbiased perspective about the technical dimensions of the works while also including codes that capture comprehensive information about the content of the evaluated works (Rose, 2007).

To illustrate the use and validity of this method, this article will describe the "Developing Minds and Digital Media" (DM2) study that was conducted at Harvard University's Project Zero Research Institute. This study was concerned with analyzing the technical and thematic dimensions of a large sample set of youth's creative productions (including literary and visual artwork) created over a 20-year period (Gardner & Davis, 2013; Weinstein, Clark, DiBartolomeo, & Davis, 2014). To analyze data from the visual artwork sample set, we developed a coding scheme that would capture in words the information embedded in visual imagery. The development of this coding scheme served as a platform for the creation of a new, comprehensive method for analyzing data from artwork that provides a clear and objective account of a large body of work. Our research inquiry did not seek to identify particular content in the artwork; instead we relied on the artwork's fundamental visual attributes to reveal compelling information.

We developed our coding scheme after reviewing existing methods of image-based research (Prosser, 1998) and interpretive tools applied to visual works (Goodenough, 1926; Harris, 1963). Although existing methods provided insight into the usefulness of image analysis in qualitative research, we found that we needed to develop a method that did not focus on interpretation criteria, such as evaluation of the human condition, measures of intelligence, or psychological assessment directives. Rather, the coding scheme developed for the purposes of the study required an objective and granular examination of the detailed components of each artwork.

In this article, a new coding scheme is introduced that identifies, isolates, and analyzes distinct characteristics (Summers, 1982) of each art piece. These isolated details, when considered together, provide a descriptive picture of the entire artwork. Characteristics such as *Line* and *Color* are coded separately; technical details such as *Medium* and *Composition* are treated as individual codes (Janson & Janson, 2001; Krages, 2005). Similarly, *Background* (Scott, 2006) is coded separately from *Subject Matter*, and *Perspective* is coded separately from *Use of Light*. The deliberate separation of individual qualities of the artwork makes it possible to recognize trends and changes over time in a quantifiable way that would not be possible if each piece were assessed in an exclusively holistic manner. We demonstrate that by identifying and recording specific elements in visual artworks, this data analytic approach enables the identification of changes or consistencies in a particular area of art production (e.g., *Composition*, *Use of Light*). The complete Visual Art Coding Scheme (in the Appendix) includes detailed definitions and descriptions for each code. We also provide two examples of the coding scheme applied to artwork so that researchers and practitioners can easily adapt and use the method.

In contrast to our approach of separating individual attributes of technique, some art historians claim that aesthetics and interpretation are intrinsically inseparable (Woodfield, 1994). With respect to this tradition, we included four codes that captured

an overall descriptive interpretation for each piece (Barnet, 2000; Burnham & Kai-Kee, 2011). By including codes that capture the holistic impression of each piece, while at the same time separating individual technical attributes, we created a database of information that includes details about technique as well as interpretive content.

In this article, we introduce the methodological approach we developed, which includes the identification of 18 codes with multiple subcodes. We demonstrate the utility of the approach by providing the DM2 research study as an example. When applying this method in a visitor-oriented setting, criteria for the production time period and the volume of portfolio pieces will be variable. It is our hope that multiple applications and investigations will benefit from research conducted by applying this novel approach to new portfolios of artwork in a variety of venues and fields of study.

### Existing Approaches to Analyzing Artwork

Existing approaches to analyzing art, especially youth-produced artworks, have a history of being limited to interpretation with the intent to reveal the perceptions of the artists (Bowker, 2007). Phenomenological studies (Bowker, 2007; Kalvaitis & Monhardt, 2012) of visual works have been conducted, but the subjective approach directs the method of data analysis. Distinct characteristics are recorded through these methods, with literal and symbolic features documented through an interpretive lens. Understanding the work as a whole is of primary importance for these studies. In contrast, we developed a coding scheme that aims to analyze individual artworks in a systematic, objective way. By singling out and focusing on discrete artistic elements such as *Medium*, *Line*, and *Background*, we believe our coding scheme provides data for an unbiased analysis of individual artworks. Thus, the coding scheme was not designed to help researchers formulate an overarching understanding of individual works but to examine fundamental details across numerous artworks to observe thematic, technical, and content-specific patterns across works.

Some researchers use drawings as a way to assess learning and understanding of specific topics. In this research approach, drawings are coded using a limited palette of criteria, accounting only for instances in which appropriate themes are depicted. An example of this approach is Bowker's study in which children were tasked with creating drawings of a tropical rainforest, and the artwork was analyzed to assess their knowledge of rainforest environments (Bowker, 2007). Although it may be useful to analyze data from visual works to aid in the understanding and interpretation of content in the artwork, Bowker's approach does not capture nuanced details that describe and assess the work as a visual object. When the primary objective of image-based research is to understand the meaning and content of a piece of artwork, technical details such as *Line*, *Background*, and *Use of Light* are not examined in isolation; rather, the work is observed as the sum of its intricate parts. However, a complete description of the artwork cannot be achieved if individual details about the technical qualities of the work are not analyzed independently from the piece as a whole.

Drawing is frequently used as a tool to illuminate evidence of learning. Methods to interpret diagrams and drawings in response to specific prompts have been developed and used to great effect (Shepardson, Niyogi, Choi, & Charusombat, 2009; Shepardson, Wee, Priddy, Schellenberger, & Harbor, 2007). The methods used to interpret the extent of learning and retention of subject matter is an encouragement to visual arts

as an interdisciplinary practice, though it does not assist in the analysis of data that will reveal qualities about the work itself.

Banks wrote about the benefits of using visual images in research investigations and created a useful guide for analyzing data from visual forms (Banks, 2001). In his investigations, he considered subject matter and specific content, which are features that we also record in fine detail. Intending to use the analyzed data to inform social and anthropological research, Banks emphasized the narrative embedded within each work. Although this narrative may reveal rich information about the content of the visual imagery, it is constructed through a subjective lens. Interpreting a narrative storyline contextualizes the visual works but limits the objectivity of the data collection.

In our coding scheme, we aim to analyze data through a lens of objectivity, using interpretation only for codes that encompass more aggregate-level information about the artwork, such as *Stylistic Approach* and *Tone*. These codes still succeed in maintaining objectivity by limiting necessary interpretation to obvious and overt descriptive elements. For example, *Tone* can be coded with qualifiers such as *Violent*, *Happy*, *Despondent*, or *Romantic* (among numerous other descriptive terms that capture the overall tone of the artwork) without requiring the researchers to assess quality, infer judgment, or make assumptions about the meaning of the work. This feature is an essential difference in the structure and function of our coding scheme when compared to existing approaches.

Existing methodologies provide a rich background for conducting research into the context, understanding, intent, meaning, and narrative in visual works. What we introduce with our novel data analytic approach is a method that captures detailed technical and interpretive attributes in isolation, resulting in an objective analysis of visual artworks. When applied to artwork produced in informal settings like museums, this approach will allow evaluators to assess art-making programs and adapt implementation procedures based on participants' visual productions.

## Developing the Method

The method described in this article was originally developed to analyze visual artworks for the Project Zero DM2 research study. This study investigated changes in adolescents' creative productions over time (Gardner & Davis, 2013; Weinstein et al., 2014). We did not approach this study with preconceived notions about what we might find, thus creating a need to develop a new, objective method of data analysis. We developed the coding scheme described in this article to analyze data from 414 pieces of youth-generated artwork that spanned over 20 years (1990–2011).

### Sample

We sourced the artwork used in our study from a comprehensive portfolio archived at *Teen Ink* magazine, a print publication producing 10 issues annually. The *Teen Ink* portfolio provided a sample set of artwork from a single, consistent, and complete source. Since its inception in 1989, *Teen Ink* has maintained an ongoing open call for creative submissions; adolescent readers (ages 13–19) submit original pieces of visual artwork for consideration. The magazine's two primary editors have remained consistent throughout its existence, ensuring a consistent curatorial eye. Original

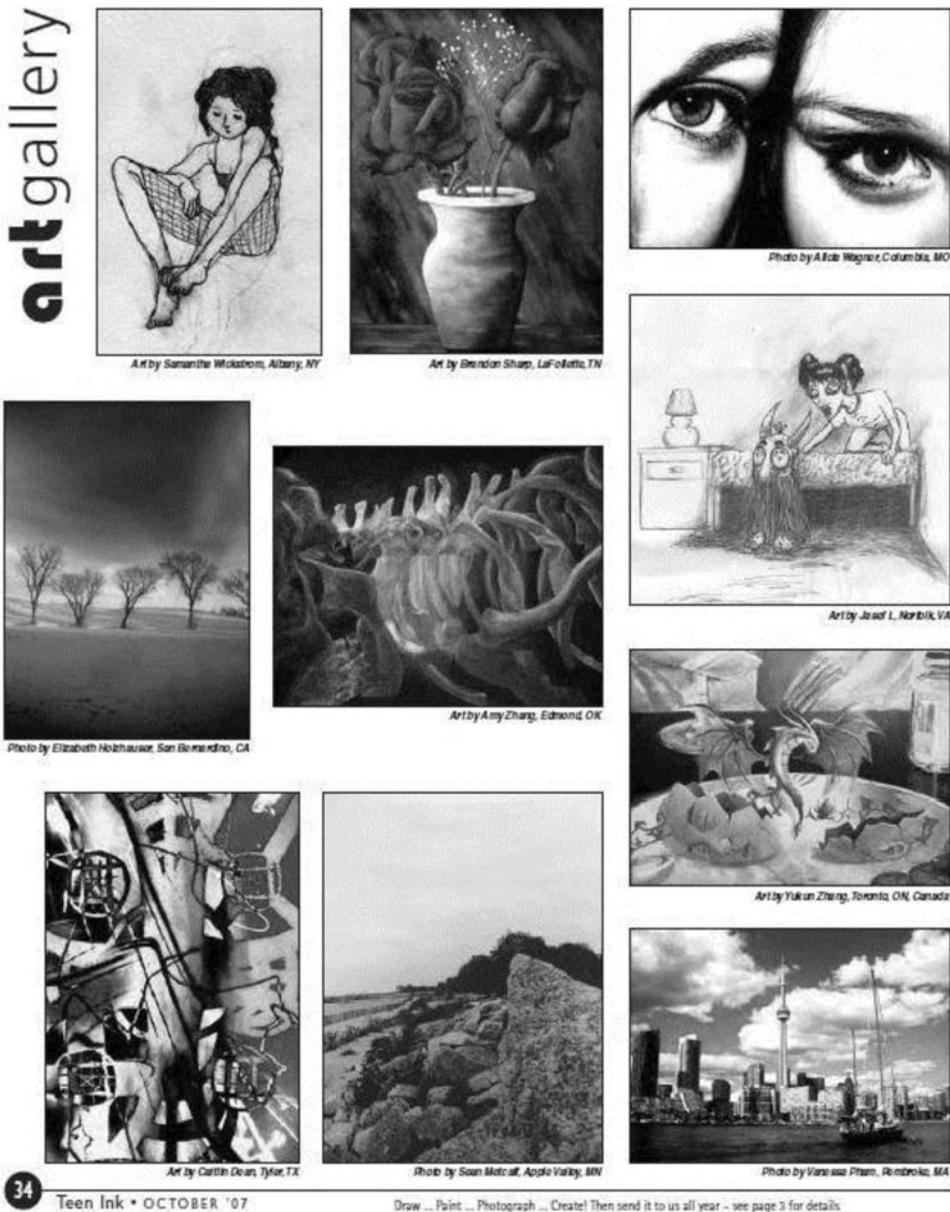


Figure 1. Example of adolescent artwork from the DM2 study. From Art Gallery, Teen Ink magazine, October 2007, p. 34. (Source: <http://www.teenink.com/Issues/2007-October.php>.)

pieces were submitted to the publication from regional artists in the northeast United States via mail for the first several years, and more recently by digital image submissions from a national readership.

Each issue of *Teen Ink* magazine includes an “Art Gallery” (Figure 1), displaying between five and 13 original art pieces. These artworks were analyzed using our novel data analytic approach. With this extensive sample set, we were able to reveal detailed data about the artwork that could be compared, cross-referenced, and quantified

to illuminate trends, differences, and similarities in the works, time periods, and characteristics of production.

Samples were selected from three time periods to constrain the scope of our research: early (January 1990 through December 1995); middle (January 2000 through December 2001), and late (January 2006 through November 2011). From these time periods, we randomly selected a total of 414 pieces. Whenever possible, the research team referred to the original artworks during the coding process as opposed to its reproduction printed within the issue.

### *Developing the Coding Scheme*

The Visual Art Coding Scheme (Appendix) was developed iteratively by two research assistants with substantial backgrounds in arts education, art history, and visual art-making. The language used in the coding scheme needed to describe accurately the specific, notable attributes of each image (Batey, 2012). Through careful consideration of recognized formal evaluation criteria for artwork and standards in art education (Janson & Janson, 2001; National Art Education Association, 1994), the researchers identified, described, and refined coding categories and subcategories prior to any application to the sample set. These categories included broad dimensions of art critique and categorization, including how the piece was made (*Medium*), in which art historical context it was situated (*Genre*), what it depicted (*Subject Matter*), and its most salient features (*Color, Light, Composition*).

The initial list of codes was drafted into a formal coding structure, which included the organization of the characteristics into two overarching categories: technical characteristics (e.g., *Color, Light, Medium, Composition*) and more holistic, content-based characteristics (e.g., *Tone, Symbolism, Theme, Stylistic Approach*). This combination of technical and holistic codes allowed the research team to observe the nature of the visual data from both a dissected perspective (separate codes for each distinct component of the piece) and as a completed work of art (the way a typical viewer would take in the visual information as a whole). Within the majority of codes, prescribed classifications were identified as subsets of the primary code; for example, the researchers compiled a comprehensive list for the *Genre* code (including *Still-life, Landscape*, and several others) and listed these predetermined identifiers within the *Genre* code as opposed to leaving the code open-ended.

Technical codes, like *Medium*, were relatively straightforward to define. This code was clearly rooted in art history and practice, and the materials are evident for each artwork even when reviewed as a digital image (Lucie-Smith, 2004). Content codes required some degree of interpretation by the researchers but were designed to include relatively clear-cut options for description. This approach allowed the research team to assign a code for *Stylistic Approach* (Sands, 2012) while refraining from quality judgments of the artwork.

Preliminary coding was conducted on randomly selected works of art, and any new characteristics that emerged from this process were added to the coding scheme (Hsiu-Fang & Shannon, 2005). This preliminary coding allowed the research team to identify details represented in the artwork that were not captured in the draft coding scheme. Codes such as *Digitally Manipulated, Dominant Figure*, and *Stylistic Approach* were added as a result of the preliminary coding process and ensuing

discussion. The choice to design an adaptable coding scheme allowed the researchers to capture specific and accurate data for each individual piece (Maxwell, 2005). The final coding scheme includes 18 codes and reflects characteristics of the entire randomized sample: 14 codes assess the technical components of the artwork and four codes assess its content-specific characteristics.

### *Description of the Coding Scheme*

Recording data for each artwork required researchers to look at the specific details of each work individually. For example, the code concerned with a piece's *Background* indicated whether the peripheral space on the page or canvas was fully rendered (completely activated by the medium), partially rendered (a combination of active and unmarked space), or left entirely blank (no markings outside of the primary subject). Data for the *Composition* code were designed to assess whether the work consisted of a static presentation of a centralized image, or if the objects were placed in a dynamic relationship on the page (Krages, 2005; Weinstein et al., 2014). *Perspective* captured the relationship of the viewer to the depicted subject; that is, whether the subject was depicted from a *Bird's Eye* (above), *Worm's Eye* (below), or *Eye-level* perspective, or if the perspective was distorted or abstracted in some way.

Within each code, the research team developed subcategories to indicate further nuance to the collected information and to record specific technical features of the artwork. For example, *Genre* was divided into two subcategories: *Realist* and *Abstract*. This allowed the research team to note key distinctions of each artwork by capturing descriptive features aligned with the selected subcategory. Subcategories were also developed for the *Medium*, *Color*, *Use of Light*, and *Background* codes.

Codes that assess the technical dimensions of the artwork were positioned at the front of the coding scheme (codes A through N in the Appendix). These are followed by codes that explore content-based facets of artwork such as *Tone* and *Theme* (codes O through Q), the reliability of which depends on the expertise of the research team, intercoder agreement, and visual evidence within the artwork. The final code, *Stylistic Approach* (R), serves as a holistic portrayal of the work to the most accurate degree possible: Given the evidence acquired via codes A through Q, how might the work be identified within the basic framework of *Conservative*, *Unconventional*, or *Neutral*? The placement of *Stylistic Approach* at the end of the coding scheme suggests its reliance on the information provided by all preceding codes. In line with this structure, the four most interpretive codes in the coding scheme appear after the technical codes are completed. This approach allows the first 14 technical codes to inform researchers with an objective set of data points with which to approach the final four codes. As a result, subjective interpretation is minimized, while the ability to record essential holistic data is preserved.

### **Application of the Method to a Sample Data Set**

To ensure that codes were applied consistently and accurately, each artwork in the DM2 study was coded twice. An initial (primary) coding was conducted by one member of the research team, followed by a second (shadow) coding by a second researcher. The researchers alternated primary and shadow coding passes so that they served in each role for half of the dataset. Attributes that most accurately described

**Table 1.** Coding memo applied to Figure 2

A. Genre	A.1 Realist Figurative	A.2 Abstract
B. Medium	B.1 Two-Dimensional Drawing	B.2 Three-Dimensional
C. Color	C.1 Palette Black/White	C.2 Dominant Color graphite
D. Composition	Balance Bottom Central	
E. Use of Light	E.1 Direction No Directional Light Source	E.2 Quality Uniform
F. Perspective	Eye-level	
G. Lines	Thin Assertive	
H. Background	H.1 Rendering Blank (No Treatment)	H.2 Content Blank (Black/White)
I. Repetition	Linear	
J. Reference to Historical Artwork	n/a	
K. Digitally Manipulated	n/a	
L. Subject Matter	Human Hand	
M. Dominant Figure	Human Hand	
N. Physical Relationship of Figures	n/a	
O. Tone	Benign	
P. Symbolism	Hand as symbolic representation of the Artist	
Q. Theme	The Body	
R. Stylistic Approach	Neutral	

the artwork were entered into a coding memo, which is a data-entry document listing the 18 codes, where attributes of the artwork can be entered, saved, and compared to the attributes of other artworks (see Tables 1 and 2).

Intercoder agreement was established through the careful structuring of the coding process. Because we developed the coding scheme collaboratively using specific and clear terms to define each code and subcode (Smagorinsky, 2008), there existed very few instances of discrepancy between the lead researcher's coding memo and the shadow codes provided by the second researcher. The occasion for disagreement occurred in fewer than 5% of the 414 coded artworks. In such cases, the research team discussed the code in question, highlighting evidence visible within the piece to support their respective coding decisions, until consensus was reached. To confirm the accuracy of the lead and shadow coding process, a third researcher completed coding memos for a randomly selected set of ten artworks from across the sample. The results were 100% consistent with the data coded by the first two researchers.

After applying the coding scheme to the DM2 portfolio, all codes included in the coding memo were analyzed through NVivo 9, a software program used for organizing data to facilitate qualitative data analysis. Queries were run to count the rate of occurrence for each code and subcode within the three time periods under examination. Coding categories that were thematically associated were sometimes



**Figure 2.** Sample of artwork from Teen Ink magazine. (Artist: Keily L. Hernandez.)

reviewed in tandem. For example, *Composition* and *Background* are interrelated features and can provide additional insight into the work if reviewed side by side.

#### **Examples of the Coding Scheme Applied to Artwork**

To illustrate the use of the method and the data that are generated in the process, we applied the Visual Art Coding Scheme to two sample artworks that are representative of images found in the *Teen Ink* portfolio.

As detailed in Table 1, the *Genre* for the piece depicted in Figure 2 is coded as *Realist* due to its portrayal of a figuratively rendered hand, which is reflected in the subcode classification *Figurative*. The *Medium* used to create this work is *Drawing*, and the *Color Palette* is *Black & White*, with a *Dominant Color* of *Graphite* noted. The *Composition* is oriented *Centrally* on the *Bottom of the Page*. Because the light appears flat and does not cast shadows or illuminate highlights, it is coded as having *No Directional Light Source*. The *Perspective* is *Eye-level*, and the *Lines* are *Thin* and *Assertive*. The *Background* is *Blank* and there is linear *Repetition* apparent in the piece. This work does not *Reference Historical Artwork*, nor does it appear to be *Digitally Manipulated*. The descriptive entry for the code *Subject Matter* for this work is *Human Hand*, and the entry for *Dominant Figure* is the same. The code *Physical*

**Table 2.** Coding memo applied to Figure 3

A. Genre	<i>A.1 Realist</i> Landscape Architectural	<i>A.2 Abstract</i>
B. Medium	<i>B.1 Two-Dimensional</i> Painting (oil/acrylic)	<i>B.2 Three-Dimensional</i>
C. Color	<i>C.1 Palette</i> Bright Limited Palette	<i>C.2 Dominant Color</i> Blue
D. Composition	Balance <i>Bottom</i> <i>Central</i>	
E. Use of Light	<i>E.1 Direction</i> No Directional Light Source	<i>E.2 Quality</i> Uniform Natural
F. Perspective	Eyelevel	
G. Lines	n/a	
H. Background	<i>H.1 Rendering</i> Fully Rendered	<i>H.2 Content</i> Landscape
I. Repetition	n/a	
J. Reference to Historical Artwork	n/a	
K. Digitally Manipulated	n/a	
L. Subject Matter	Lighthouse, Sky, Seagulls, Sand, Sea/Water	
M. Dominant Figure	Lighthouse	
N. Physical Relationship of Figures	Touching	
O. Tone	Serene Traditional	
P. Symbolism	n/a	
Q. Theme	Isolation/Solitude Reflection Nature	
R. Stylistic Approach	Conservative	

*Relationship of the Figures* would be left blank in this case, as there is only one figure in the drawing.

The *Tone* of the drawing is *Benign*, as there is no explicit message or emotive element conveyed through the work. The depiction of the hand could be a symbolic representation of the artist, and this is noted in the *Symbolism* code. This code requires informed interpretation of the artwork by researchers referring to the content of the previous codes, and a background in art history and knowledge of common practices in art. The *Theme* relates to *The Body*, and the *Stylistic Approach* is most accurately *Neutral*. This code is influenced in part by the *Benign* classification in the *Tone* code and the codes that indicate the artist's straightforward use of tools and techniques.

As shown in Table 2, the *Genre* of the piece depicted in Figure 3 is *Realist*, with subcode classifications of *Landscape* and *Architectural*. The *Medium* is *Painting (oil/acrylic)*, and the *Color Palette* is a *Bright, Limited Palette*, with a dominant color of *Blue* noted. The *Composition* is oriented *Centrally* on the page. There is *No Directional Light Source*, with a *Uniform* and *Natural Quality*. The *Perspective* is *Eye-level*, and there are no distinct *Lines* in the piece. The *Background* is *Fully*



**Figure 3.** Sample of artwork from Teen Ink magazine. (Artist: Joanna Meyer.)

*Rendered* and contains *Landscape* imagery. This work does not *Reference Historical Artwork*, nor does it appear to be *Digitally Manipulated*. The descriptive entry for the code *Subject Matter* for this piece is *Lighthouse, Sky, Seagulls, Sand, and Sea/Water*, and the entry for *Dominant Figure* is *Lighthouse*. The code *Physical Relationship of the Figures* would be *Touching*, as the edges of the *Lighthouse, Sky, and Sea* (the central figurative elements contained within the piece) intersect.

The *Tone* of the painting is *Serene* and *Traditional*. The work does not contain any apparent *Symbolism*. The *Theme* relates to *Isolation/Solitude, Nature, and Reflection* due to the portrayal of a secluded landscape. The *Stylistic Approach* is most accurately *Conservative*. These codes have been assigned through observation of isolated attributes of the artworks, and by providing holistic, descriptive features of the work without subjective judgment or interpretation.

### ***Illustration of Results Derived from Utilizing this Method***

When using the method introduced here, information entered into the coding scheme produces a substantial dataset that can be rigorously analyzed. For example, the DM2 research team found a statistically significant difference between the ways in which the background was treated in earlier works compared to more recent works (Gardner & Davis, 2013; Weinstein et al., 2014). Our analysis revealed that the earlier pieces were more likely to contain unfinished or blank backgrounds, whereas more recent pieces were more likely to include fully rendered backgrounds. Other changes in the DM2 portfolio were identified in both technical (e.g., *Medium, Composition, Genre*) and thematic (*Stylistic Approach*) codes. The analysis also highlighted

consistencies across the 20-year period, most notably in the *Subject Matter* code, where the primary topic of *Animals/Pets* was featured throughout the entire portfolio.

## DISCUSSION

Although the sample selection described here is specific to the DM2 study, the successful implementation of the Visual Art Coding Scheme may be achieved with any sample of visual artworks. The breadth and variety of data provided by the DM2 sample set served as an excellent testing ground for the initial implementation of this method.

### Virtues of the Coding Scheme

By suspending judgment of the overall interpretation of what is happening in an artwork in favor of analyzing its isolated, fundamental artistic elements, researchers were able to develop theories about what the artwork revealed based on explicit, identifiable information present in the artwork. Our coding scheme represents a unique tool that allows data to be analyzed through the most objective strategy possible, thus creating a platform for researchers to study artwork by investigating their research question with a data set that is true to the objects it represents.

Although existing methods in the fields of social science and visual anthropology may provide useful narrative descriptions about the artwork as a whole (Banks, 2001; Prosser 1998), they may not provide a similarly comprehensive investigation of the fundamental attributes that comprise that artwork. Banks includes some technical features in his coding process, such as the surface of the artwork and the spatial relationship of figures in the image, but in his analysis these elements once again serve the interpretive agenda of understanding the meaning of the image.

A more overt example of using interpretative strategies in the analysis of visual art is the Draw-a-Person test, developed by Goodenough (1926) and revised by Harris (1963). This system of coding artwork focuses on 14 aspects of a figurative drawing, with 64 codes and subcodes for each artwork. Combined attributes are analyzed by researchers to determine the psychological condition of the artists or to measure their intelligence. In contrast, our method is designed to analyze features of the artwork itself, rather than attempt to decipher the status of the artist producing the work.

Our method focuses on each artwork as an independent object and can be applied without drawing subjective inferences about the work. In studies that use prompts to generate artwork, a lens of subjective assessment and critique are put into play before the analysis even begins. For example, the Kalvaitis and Mondhardt (2012) study explicitly attempts to reveal children's knowledge and relationship with nature by asking the children to draw pictures of themselves outdoors. The drawings were considered tools for data collection rather than independent art pieces. The images of children interacting with nature were coded and analyzed, limiting the data set to information relevant to a single research question.

Methods that analyze drawings as a barometer of subject-specific learning provide narrow insight into the artwork itself. Shepardson et al. (2009) implement a methodological approach to visual artwork interpretation by prompting students to

draw and explain the greenhouse gas effect, followed by an analysis of the drawings to determine students' understanding of the phenomena. An earlier study uses similar methods to evaluate students' knowledge of watersheds (Shepardson et al., 2007). By focusing on specific content in the drawings, this method captures broad thematic motifs rather than specific visual content.

Because our coding scheme offers an approach that examines 18 attributes in isolation, it allows researchers to observe trends that occur within each visual attribute and patterns that emerge when viewing multiple characteristics in concert. That is, a code such as *Medium* may be analyzed on its own or in the context of other codes, such as *Composition* or *Tone*, to attain a deeper understanding of how the attributes interact with one another at the granular level. Because our method does not depend on subjective interpretation or judgment of artwork, and the visual work is not derived from a directive prompt, we are able to achieve a rich record of the visual object.

Whether visitors produce artworks as a reaction to an exhibition, as part of an open-ended materials exploration, or as an assigned project, the product of their individual efforts contains a wealth of information about the artist, the program, and the setting in which it was produced. Our method provides the most objective, detailed, and flexible option for extensive data analysis of visual work.

### Limitations

The limitations of this data analytic approach lie within the sample set of artworks to which the method is applied. If a sample set of artworks is produced hastily, the data collected from each piece may not reveal detailed information about the artists. In museum programmatic settings where time is limited, and prior training and skill are highly variable, the potential for the data to reveal significant information about the group of artists is unclear. However, technique and content will be clearly noted in the data set, and the outcomes and effectiveness of the program itself can be evaluated with detailed accuracy by applying this method to the artworks. In addition, the approach offered by our coding scheme mitigates the influence of artistic quality in analysis. As attributes are examined individually and not as the sum of its parts, researchers may focus on the presence of individual attributes within the artwork rather than an overall judgment of its artistic value.

### CONCLUSION

The method described and illustrated in this article introduces a novel approach to collecting data from visual artwork. The coding scheme outlined here allows researchers to isolate and identify specific and quantifiable aspects of visual expression, and to create a complete record of a visual piece while preserving the ability to analyze specific attributes that comprise each work. This new data analytic approach provides objective insight and detailed information about visual artwork that could not be attained through existing methods that rely on interpretation and assessment of the work as a whole. In addition to recording objective, granular data from each piece, our method is capable of creating a comprehensive record of massive amounts of visual information while preserving specific details about each artwork through

an unbiased lens. Artistic form and materials are individually noted, enabling the identification of trends that are not immediately obvious to the viewer.

This method provides researchers with a tool that can be easily adapted for use in studying permanent collections, large portfolios, products from on-site activities, and visual artwork produced under a variety of conditions. The data may reveal information about the success of a visual art activity through the analysis of codes specific to the goals of an assignment or program. Because the coding scheme isolates the unique technical components of the artwork, researchers and educators are afforded the option to observe codes separately, pair relevant codes for analysis, or analyze the artwork through the entire 18-code scheme. The coding scheme covers a broad and comprehensive range of attributes in the artwork, capturing a detailed, nuanced, and overall impression of each piece. Because of this unique combination of flexibility and depth, the data analytic approach outlined in this paper provides researchers and practitioners with a rich, objective, and methodical language through which visual art may be both studied and discussed, observing trends and differences across distinct pieces.

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## APPENDIX: VISUAL ART CODING SCHEME

<p><b>A. Genre</b> Genre describes the art historical context which the piece most closely resembles, categorizing the artwork into one of two subcodes: (A.1) Realist and (A.2) Abstract.</p>	<p><i>A.1 Realist</i> Impressionist, Cartooning/Anime, Landscape, Documentary, Fantasy, Decorative, Figurative, Folk, Found Object, Graffiti, Outsider Art, Portraiture, Religious/Sacred, Symbolist, Tribal, Body Art, Illustration, Still Life, Surrealist, Psychedelic, Conceptual, Architectural, Photography, Color Field</p>	<p><i>A.2 Abstract</i> Impressionist, Cartooning/Anime, Landscape, Documentary, Fantasy, Decorative, Figurative, Folk, Found Object, Graffiti, Outsider Art, Portraiture, Religious/Sacred, Symbolist, Tribal, Body Art, Illustration, Still Life, Surrealist, Psychedelic, Conceptual, Architectural, Photography, Color Field</p>
<p><b>B. Medium</b> Medium describes the material used to physically execute the piece.</p>	<p><i>B.1 Two-Dimensional</i> Photography, Painting (oil/acrylic), Drawing, Watercolor, Pen and ink, Collage, Mixed Media, Digital Art, Printmaking, Textile, Public Art, Found Art, Pastel</p>	<p><i>B.2 Three-Dimensional</i> Photography, Painting (oil/acrylic), Drawing, Watercolor, Pen and ink, Collage, Mixed Media, Digital Art, Printmaking, Sculpture, Ceramics, Textile, Installation, Public Art, Found Art, Pastel</p>
<p><b>C. Color</b> Color reflects the piece's general palette and/or use of specific colors.</p>	<p><i>C.1 Palette</i> Warm, Cool, Bright, Muted, Black/White, Contrasting, Complimentary, Limited Palette, Monochromatic, Saturated, Rich, Varied, Negative Space Balance (<i>Left, Right, Top, Bottom, Central, Uniform</i>), Cropped, Symmetrical, Dynamic</p>	<p><i>C.2 Dominant Color</i> (note dominant colors here)</p>
<p><b>D. Composition</b> Composition addresses the placement or construction of the subject matter on the visual plane.</p>	<p><i>E.1 Direction</i> Left, Right, Top, Bottom, Front, Back, Central, No Directional Light Source</p>	<p><i>E.2 Quality</i> Underexposed, Overexposed, Washed Out, Backlit, Translucent, Dramatic, Uniform, Natural</p>
<p><b>E. Use of Light</b> Use of Light describes the presence of light within the piece and the degree to which it is rendered.</p>	<p><b>F. Perspective</b> Perspective specifies the relationship between the viewer and the subject matter of the piece.</p>	
<p><b>G. Lines</b> Lines makes a notation of the quality of lines that appear in the artwork.</p>	<p>Thick, Thin, Sharp, Blended, Organic, Structured, Assertive, Timid, Exploratory</p>	

(Continued on next page)

*Appendix (Continued)*

<b>H. Background</b>	<i>H.1 Rendering</i>	<i>H.2 Content</i>
Background records details about the space surrounding and beyond the primary subject matter situated in the foreground.	Fully Rendered, Partially Rendered, Blank (No Treatment), Single Color	Landscape, Cityscape, Architecture, Expansive, Tight, Interior, Abstract, Collage, Color Field, Blank (Black/White)
<b>I. Repetition</b> Repetition can appear in both abstract and realist pieces and the subject matter repeated may be symbolic, figurative, or non-objective.	Scattered/Random, Uniform, Linear	
<b>J. Reference to Historical Artwork</b> Reference to Historical Artwork does not include prescribed classifications. Overt references to existing artwork may be noted within this code.	(enter notes here)	
<b>K. Digitally Manipulated</b> Evidence of digital manipulation, such as effects applied using Adobe PhotoShop, can be recorded under this code.	(enter notes here)	
<b>L. Subject Matter</b> Subject Matter contains no prescribed classifications. This code serves as a brief description of the subject of the piece.	(enter notes here)	
<b>M. Dominant Figure</b> Dominant Figure reflects the artwork's most prominent figure, if a figure is present in the work.	(enter notes here)	
<b>N. Physical Relationship of Figures</b> Physical Relationship of Figures addresses the visual relationship between figures (figurative and non-objective) depicted in the piece.	Close, Distant, Touching, Embracing, Looking at a Figure, Looking Away from a Figure, Object Between Figures, Space Between Figures	
<b>O. Tone</b> The classifications within Tone represent the mood or disposition of the piece, influenced by previous codes and using evidence from the artwork.	Violent/Aggressive, Romantic, Mystical, Benign, Sinister, Despondent, Solemn, Humorous, Happy, Playful, Narcissistic, Competitive, Serene, Melancholy, Traditional	

*(Continued on next page)*

**Appendix** (Continued)

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**P. Symbolism**

(enter notes here)

Symbolism is intended as a space for coder to note obvious symbolism depicted in the piece, if any exists.

**Q. Theme**

Theme addresses the primary message that is conveyed through the subject matter of the piece, influenced by previous codes and using evidence from the artwork.

Identity/Self, Narcissism, Isolation/Solitude, Introspection, Reflection, Relationships (*Friendship, Community, Family, Romantic*), Intimacy, Nature, Animals/Pets, Urban Life, Branding, Fashion, Entertainment, Ephemera, Materialism, Money, Spirituality, Imagination/Fantasy, School, Work, Home, Play, Age (*Youth, Peers, Adults, Elders*), Sports, The Body, Mimicry, Cultural Perspectives, Sexualization, Race, Death/ War, Political

**R. Stylistic Approach**

Stylistic Approach is the final code in the coding scheme and is designed to provide the coder with the opportunity to offer a simple holistic description of the artwork, influenced by previous codes and using evidence from the artwork.

Conservative, Neutral, Unconventional

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