Asian Research Journal of Mathematics

10(2): 1-13, 2018; Article no.ARJOM.42277
ISSN: 2456-477X

Contour Classification in Drawing Based on Fuzzy Thinking

Mehdi Asasian[1*]

[1]*Department of Applied Mathematics, Sharif University of Technology, Tehran, Iran.*

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/ARJOM/2018/42277
Editor(s):
(1) Xingting Wang, Department of Mathematics, Temple University, Philadelphia, USA.
Reviewers:
(1) William Obeng-Denteh, Kwame Nkrumah University of Science and Technology, Ghana.
(2) Chiheb Ben Regaya, University of Tunis, Tunisia.
(3) Rajesh K. Thumbakara, M. G. University, India.
Complete Peer review History: http://www.sciencedomain.org/review-history/25753

Method Article

Received: 5th May 2018
Accepted: 14th July 2018
Published: 31st July 2018

Abstract

Throughout the history of art, the methods used to analyze the form of artwork have become important in this regard; they have focused on important aspects such as easier learning methods and better critique of artwork. In this regard, modern and contemporary art seems to require a new instrumental geometric and formal language to analyze the form with the help of meaningful geometry, in order to create a solution to formal challenges in recent decades, especially in the drawing field. Following the previous works, this paper presents a series of necessary definitions of meaningful visual forms, which, on the one hand, preserves the individuality of modern and contemporary art and, on the other hand, is a common language for artistic dialogue in the fields such as critique and art education. Here, we provide definitions for contour and classify base samples of it and its meaningful functions. These definitions are the basis for our next papers in the field of analyzing deformation in art.

Keywords: Fuzzy thinking; fuzzy geometry; possibility theory; modern art; contemporary Art.

1 Introduction

Real-world issues usually have a complex structure due to the ambiguity and uncertainty in their definition and understanding. Since human beings have been able to think, he has always faced ambiguity in various social, technical and economic issues. Even the invention of the computer and its application development in

**Corresponding author: E-mail: asasianart96@gmail.com;*

the real-world analysis did not solve the problem of ambiguity and uncertainty. In this regard, the visual arts, especially from the 20th century on, have come up with a range of technical creations and individual perceptions of the world. For this reason, there are logical, verbal and analytic complexities in the fields of art critique and education.

Introducing the theory of fuzzy sets, Professor Lotfi A. Zadeh (1965) provided the grounds for modelling inaccurate information and approximate reasoning with mathematical equations for the first time; it is a great transformation in mathematics and classical thinking [1]. The idea of the theory of fuzzy sets came up with this approach by Lotfi A. Zadeh saying that we need another kind of mathematics to model the ambiguities and uncertainties of events, a model which is different from the probability theory. From that date on, there have been studies on the general connection between fuzzy thinking and various scientific topics, including aesthetics, conducted by researchers such as Bart Kosko. He, in his book [2] refers to this example that: Can we draw a circle? No one has seen a circle. No one has ever seen a square or a triangle or an oval or any of the geometric shapes. We have only seen approximations of them. We have seen their flawed grey spectra instead of their full black and white images. If we look closely at the picture and look at it in detail, we will see drawbacks in drawing or carving, or even in the set of fundamental particles. This simple but deep example leads us to the theory of imposing a mental form on the peripheral phenomena raised in the discussion of formalism by philosophers such as Kant and makes the initial sparks in mind for the compatibility of fuzzy thinking with analyzes in art.

In articles [3,4], we talked about the history of the philosophy of art in the subjects of form and formalism. The cases can be found in [5-10]. In this series of articles, our goal is not to address topics related to the philosophy of art or the historical-sociological roots of artworks. Instead, we try to take into account these discussions to link the fuzzy logic and fuzzy geometry and the discussion of formalism and aesthetics in art, especially modern and postmodern art. In this regard, we try to find a language to speak about the qualities of form and the form-oriented analysis of these works, so that this language and results, on the one hand, carry the artist's mental-behavioral actions and, on the other hand, be able to maintain the results and analyzes available for classical artworks, the same formal critiques and analyzes which are based on classical geometry. In this context, we defined the meaningful point and line in [3] and provided a definition for the meaningful surface in [4]. These definitions were such that the artist could incorporate his own view of the formal measurements and geometric visual elements into artwork, and we could also move towards the creation of a logical-formal language for analysis of the modern and contemporary artworks. A common language that protects Kantian individualism.

In this paper, based on the definition of a meaningful point and line, we define the meaningful contour and discuss the meaningful function describing the different contours and the states and conditions of their creation through the artist's actions. In a brief section, we refer to the position of the concepts mentioned in the possibility theory. Then we analyze the artist's mental-behavioural actions in the artwork. In this regard, we describe our work by bringing examples of art history. It should be noted that the author has provided some works of his experiences in the paper, as laboratory and workshop results, defined in terms of meaningful geometry. These results are from the author's mental-behavioural actions in dealing with the drawing subject and the form imposed by the author's mind on the phenomena of the drawing subject and are due to his personal impression from the subject. In this way, the arguments presented in this paper are taken out of mere theoretical analysis and are supported by workshop results.

2 Meaningful Contour

After the emergence of fuzzy logic, as in other branches of mathematics and science, many works have been done in fuzzy geometry that can be seen in [11-19]. Based on this, we presented definitions of the meaningful surface, point and line in [3,4]; In [20], we presented the importance of having a fuzzy definition of contour in dealing with deformation in visual arts in the form of a method for deformation. We provided a definition for meaningful contour based on fuzzy geometry. Here, we will continue our policy of dealing with the modern art in a fuzzy form to present a kind classification in this field from the fuzzy perspective. Here we present some equivalent definitions of meaningful contour that are more efficient in artistic use.

Undoubtedly, we are avoiding articles presented in the field of meaningful contour, having algorithmic aspects (such as those presented in the computer science field). Because we never seek to inject an algorithmic look into the field of creation of artwork or its critique, but we try to enter a more efficient logic with a term more familiar to the minds of artists, into the visual field. Providing a proper definition, we will open the way for a geometric-fuzzy critique in the following articles. And It should be noted that the scope and diversity of forms in modern and contemporary art are so broad that when criticizing, one can use one of the following definitions under the conditions of the analysis.

Note: In these papers, our main goal is not to expand fuzzy geometry, but to provide a geometric statement useful for practical purposes in visual arts, so that they can be easily understood by the audience and the artist.

Definition 2.1: If the set of points of the meaningful surface is called the reference set of X (painting meaningful surface), then the meaningful contour is a set of points that belong both to the positive space A and to the negative space $\overline{A}$ (complementary set of A), see Fig. 1, or it can be said that the meaningful contour is the strip made of the positive and negative spaces(that the subset operator is considered to be a fuzzy operator here).

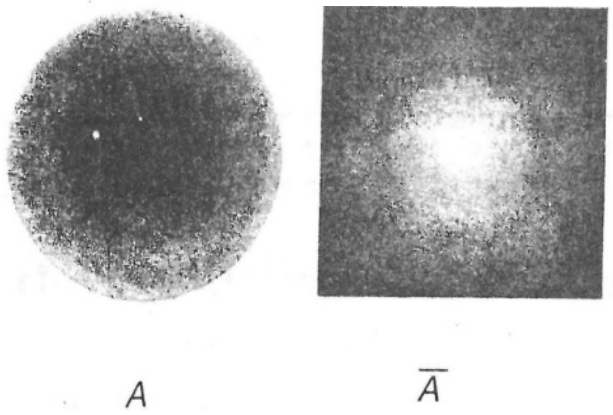

Fig. 1. Meaningful point A and its complementary set $\overline{A}$

Definition 2.2: Meaningful contour is the boundary between a set of meaningful positive points and a set of meaningful negative points on a meaningful surface.

Note: This boundary can include different layers of the artist's mind on a meaningful surface.

Definition 2.3: Meaningful contour is a meaningful closed line that divides the meaningful surface into two positive and negative regions.

Definition 2.4: Meaningful contour is the set of meaningful points forming the outer edges of the positive space on a meaningful surface.

Definition 2.5: Meaningful contour is the meaningful line passing through the outer edges of the drawing subject.

These definitions are helpful in describing the deformation of visual works in the next article. For example, Fig. 2 is an example of meaningful contour drawn by the outer edges of the subject. This contour has passed through the edges of the pot in a way that a group of lines have passed through the positive space and another group of lines have passed the negative space of the drawing at the same time. The black doted line is the crisp contour with the meaningful function value of one.

Fig. 2. Meaningful contour has passed through the edges of the pot

For another example, consider the drawing in Fig. 3. This drawing which drawn with the width of the coal on soft paper is a meaningful line that passes through the outer edges of the figure and separates the positive and negative spaces of the drawing from each another. Using the width of the coal and the intensity of contour's darkness has given different meanings in different points indicating the sensory-mental meaning of the author in dealing with the subject of the drawing.

Fig. 3. Drawing by mehdi asasian- coal on paper-106*120CM-2017

3 Types of Meaningful Functions

In this section, we give base samples of situations that can be created when drawing a meaningful contour, and describe them with meaningful functions. Of course, these examples do not necessarily include all possible modes because every artist has his handwriting depending on his instrument, material, and mental-behavioural conditions, which must be individually formally criticized. Here are some examples to better understand the content of our previous section. If the verbal word "darkness" is the basis for making a meaningful set and meaningful function, then everywhere in our contour, which is darker, the value of its function is closer to one, and the value of the meaningful function of the brightest place in the contour is zero.

First mode: The simplest form of the meaningful contour is the time when all of the contour's points have the same value in terms of darkness. Fig. 4 is an example of such a meaningful contour. In this case, the meaningful function of this contour is a step-wise function like Fig. 5.

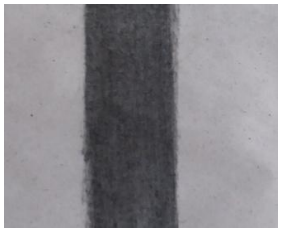

Fig. 4. Part of meaningful contour creating by coal on paper

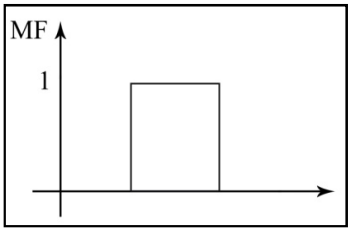

Fig. 5. Corresponding MF of contour Fig. 4

Second mode: In this meaningful contour, we have a central darkness section that gets bright when reaching the edges of the contour like Fig. 6 or Fig. 7. In this situation, we can describe the type of material and behavioural actions of the artist by Gaussian or trapezius diagrams (which can be symmetrical or asymmetric), See Fig. 8 or Fig. 9.

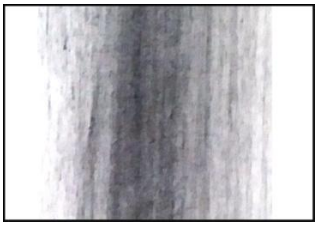

Fig. 6. Part of meaningful contour creating by coal on paper

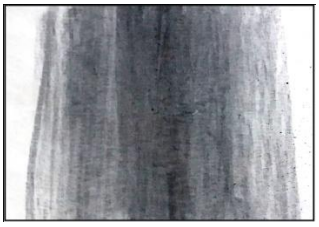

Fig. 7. Part of meaningful contour creating by coal on paper

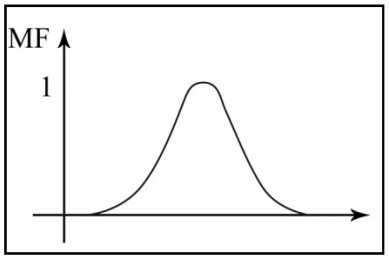

Fig. 8. Corresponding MF of contour Fig. 6

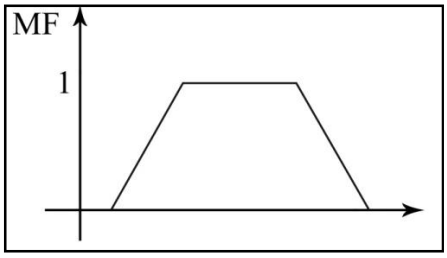

Fig. 9. Corresponding MF of contour Fig7

Here, If the "intensity of brightness" is the criterion of our analysis, then there are fuzzy contradictory diagrams, for example, for a trapezius diagram of Fig. 9 we have Fig. 10.

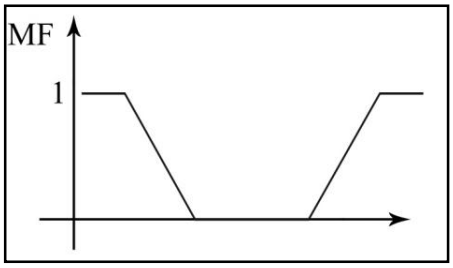

Fig. 10. Fuzzy contradictory diagrams of diagram Fig. 9

Third mode: In this mode, we have two significant segments of darkness on both sides of our contour that reach the central bright section with a grey spectrum, like Fig. 11. The proposed diagram for describing this mode can be like Fig. 12.

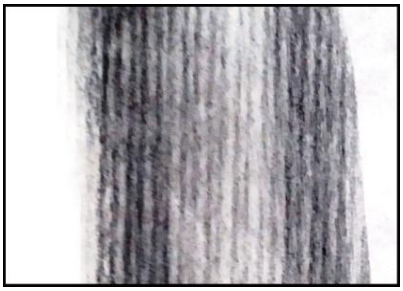

Fig. 11. Part of meaningful contour creating by coal on paper

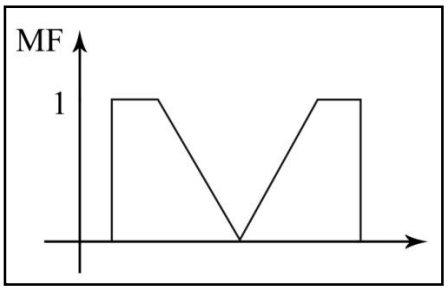

Fig. 12. Corresponding MF of contour Fig. 11

Note: In this situation, we face a non-convex meaningful function; if we place the aesthetic criterion on convexity then can compare the status of the artwork with its different sections as well as other artistic works to have a visual quality supporting individuality.

Fourth mode: In this situation, we deal with two dark-to-bright spectra in the contour studied, like Fig. 13. Here, the tools and materials used in drawing (or painting) have a state that creates two strips with each move. For a geometric-verbal description of this mode, we can propose the diagram like Fig. 14.

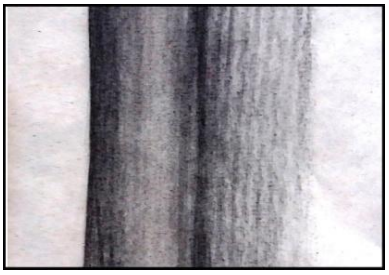

Fig. 13. Part of meaningful contour creating by coal on paper

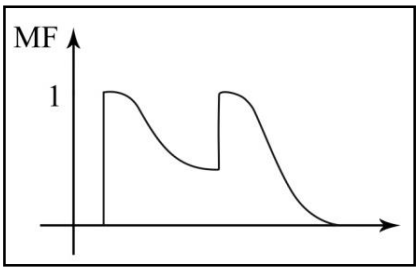

Fig. 14. Corresponding MF of contour Fig. 13

Note: Apart from convexity, we can talk about the direction of light and shadow, or the visual qualities and pressures of the artist's handwriting, using the diagram of meaningful functions.

Note: the Logical negation of the third and fourth modes diagrams can also be defined and reviewed.

These basic modes are referred to as the most commonly used modes in art. Certainly, according to each artist's work, his personal patterns can be extracted in the same way. But let's consider the reverse of the problem. When teaching visual arts, we ask our audience (student) to provide a meaningful contour with the condition of a diagram like Fig. 15.

This graph well tells the audience what our opinion is about the direction of light and shadow, the intensity of darkness, the width of the contour spectrum, and the tone of darkness diffusion in different parts of the meaningful contour. Then, we leave the student alone to work with the tools of his own, and with his emotion and mental-physical conditions and individual actions in the face of the painting subject; these actions do not lack creativity and innovation.

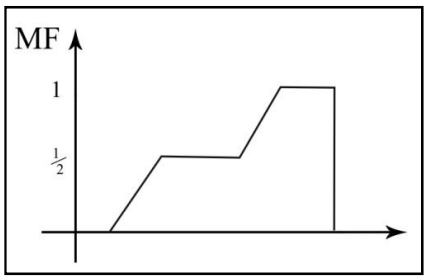

Fig. 15. Meaningful function for teaching a meaningful contour

4 Meaningful Contour and Possibility Theory

In recent years, various interpretations of the theory of fuzzy sets have been proposed, one of which is the Possibility Theory. Here, we do not want to go into the possibility theory, we only present an example of conceptual art to show how the theory has the capacity to model and transport concepts in conceptual and contemporary art.

One of the main concepts of probability theory is the possibility of distribution which is defined based on the fuzzy restriction. For a better understanding of a fuzzy restriction, consider the elasticity of a suitcase, which acts as a restriction with respect to its volume. For a suitcase with a hard coat, its volume is a certain number, but for a travel bag, the volume of the contents depends on its elasticity. In this case, the variable can be the volume of contents inside the travel bag and the values of this variable can be assumed to be ($u \in U$) and the degree of a variable x can be defined according to different amounts of u which is stated by ($\mu_{\tilde{F}}(u)$) that we call it meaning degree in our works. Professor zadeh defined these relationships as follows.

Definition 4.1: Let $\tilde{F}$ is a fuzzy set with the global set U and membership function $\mu_{\tilde{F}}(u)$. $\tilde{F}$ will be a fuzzy restriction on the variable X; if $\tilde{F}$ acts as an elastic constraint on the values that may be allocated to X, assigning the values of u to X is as follows:

$$X = u : \mu_{\tilde{F}}(u)$$

$\mu_{\tilde{F}}(u)$ is an extent to which the restriction displayed by $\tilde{F}$ is provided when u is assigned to X.

Fig. 16. Possibilistic "Sardis".by Mehdi Asasian. 32*17.5*1.5CM-2017

We will move our discussion into an artistic example by the author, and leave the rest of the theory for the future works. Here, we consider the following work of the author called Possibilistic "Sardis", Fig. 16. This work is made up of a metal tray; when the audience looks in it, he/she sees a hallo around his/her head.

In fact, this is a possibilistic statement of the person viewing. A portrait made with an elastic contour. Because of the distortion and quality of the metal used in this work, we do not have a definite contour, like a mirror, around the viewer's portrait, but a bunch of lines of varying degrees of contrast, forming a possibilistic contour for the picture inside the tray. It appears as though they display different images of the audience, each of which is a feature of his/her personality at the same time. And this depends entirely on the personal perception of the audience at that moment of the art work, and this is the same policy as in the contemporary art. On the other hand, the verbal term "Sardis" in Farsi refers to the statue of a head, which has been used for verbal play according to the language capacities of the Persian language, in order to create a sensory meaning in the mind of the audience while referring to the head in the tray. In fact, the possibility theory in this context can cover the elastic states of a verbal form produced in the mind of the audience and can philosophically carry a formal-semantic critique load.

5 Samples and Modeling

Fig. 17, has been produced from the collision of coal on soft paper. As we see, we do not have a constant action-emotional rhythm in this contour. This is because of the darkness of the different parts of the contour. For example, the darkness intensity diagram for Sections 1 and 2 can be as shown in Fig. 18 and Fig. 19, respectively. But for Section 3, the amount of hand pressure on coal has fallen to that of Section 2, which can be plotted as in diagram Fig. 20. This shows that the lack of coherence in the painting action is meaningful to produce this contour.

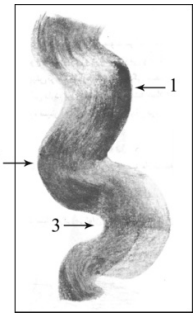

Fig. 17. The collision of coal on soft paper

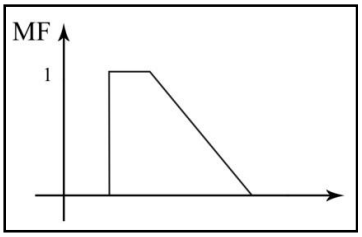

Fig. 18. MF of section 1

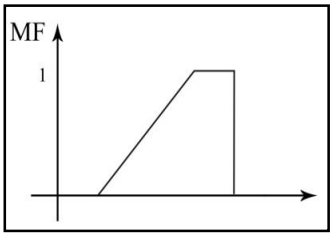

Fig. 19. MF of section 2

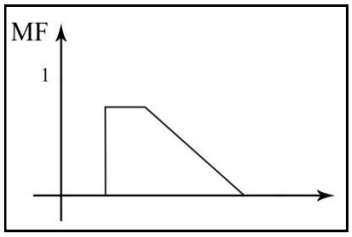

Fig. 20. MF of section 3

The drawing in Fig. 21 is a work by Paul Kelly, which is created by the width of the coal. In this figure, we see a meaningful contour that has crossed the meaningful points of the figure edges. Two points of the environmental meaningful points of this drawing are shown in a distinct form. In fact, as according to the alpha cut of the meaningful functions, we have shown a visual scheme of a meaningful line passing through meaningful points in article [3], the same meaningful line can now be used to describe a meaningful contour passing through the meaningful points imaginable at the edges of the drawing subject.

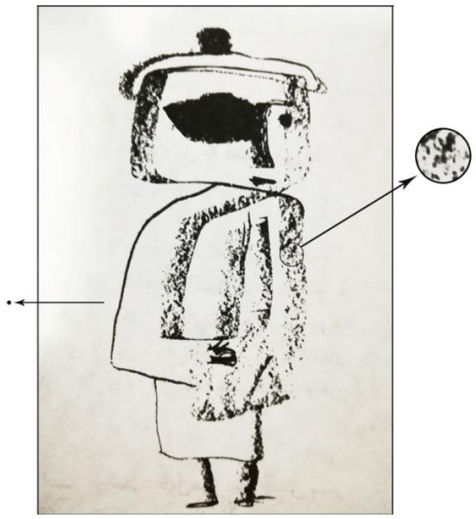

Fig. 21. Meaningful contour and sample of meaningful points in the drawing of Paul Kelly

In Fig. 22 and Fig. 23, we see two drawings by Käthe Kollwitz. In these two works, the painter's behaviours are relatively coherent in contour production, and the darkness pattern is maintained coherently in the whole contour.

Fig. 22. Meaningful contour in drawing by Käthe Kollwitz

Fig. 23. Drawing by Käthe Kollwitz- coal on paper

Now, here we examine a different mode. In Fig. 24, we see a work of Alberto Giacometti, a Swiss artist of the twentieth-century, created with a metal point and ink. In this kind of work that is a sketch, we have a series of discrete lines in the contour created according to the tools used. In fact, these lines are choices from within the meaningful line constructing the contour. For this reason, it creates a semi-continuous form in the mind that is visually associated with a broad line. For example, consider a piece of meaningful contour indicated with the "c" sign. We have shown the meaningful line, from which the section "c" is selected, in a magnified form in Fig. 24.

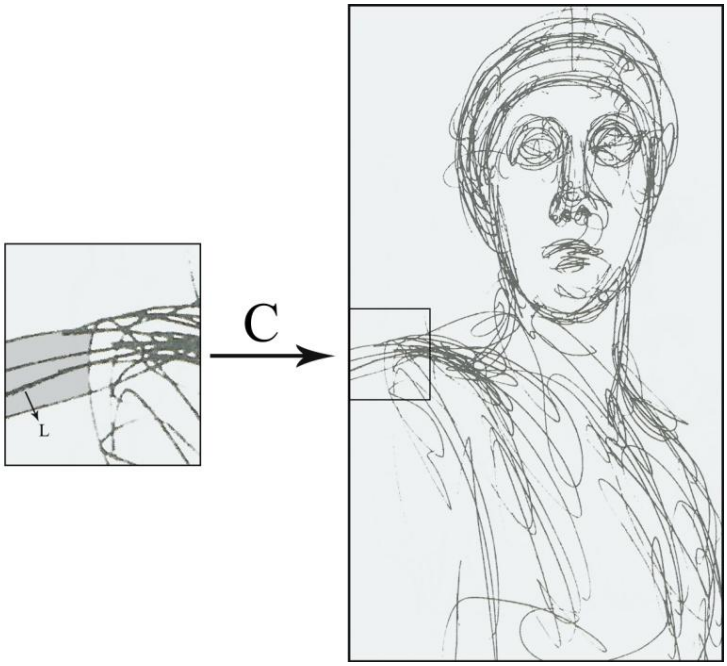

Fig. 24. Meaningful contour in art work of Alberto Giacometti

If we consider the line "L" in the meaningful contour of "c" as the darkest line in this set of lines, we find that we have a meaningful asymmetric contour in section "C" that can be graphed as Fig. 25.

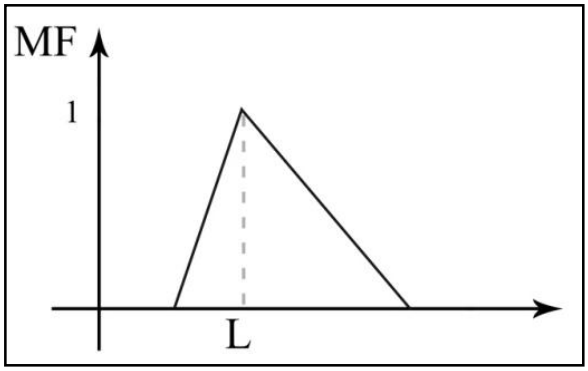

Fig. 25. Corresponding MF for section "C" of fig 24

Fig. 26 is also another example of this kind of contour meaning that the set of discrete lines selected from within a meaningful line, describes this contour. At the same time, they form a meaningful strip in the mind of the viewer in a post-perceptual process that is drawn around the figure.

As the last example, consider the asymmetric meaningful contours in Sections 1 and 2 in a work by Ben Hogwarts, see Fig. 27. Here we have an asymmetric contour in section 1, which only contains a positive space represented by a diagram like Fig. 28. In Section 2, we have a meaningful contour that simultaneously contains the positive and negative spaces together, and we describe it based on the intensity of the darkness as Fig. 29. In this form, in terms of a meaningful function, the dotted lines, L_1 and L_2 are the places with the highest meaning, i.e. the value of one.

Fig. 26. Drawing by discrete lines in meaningful contour

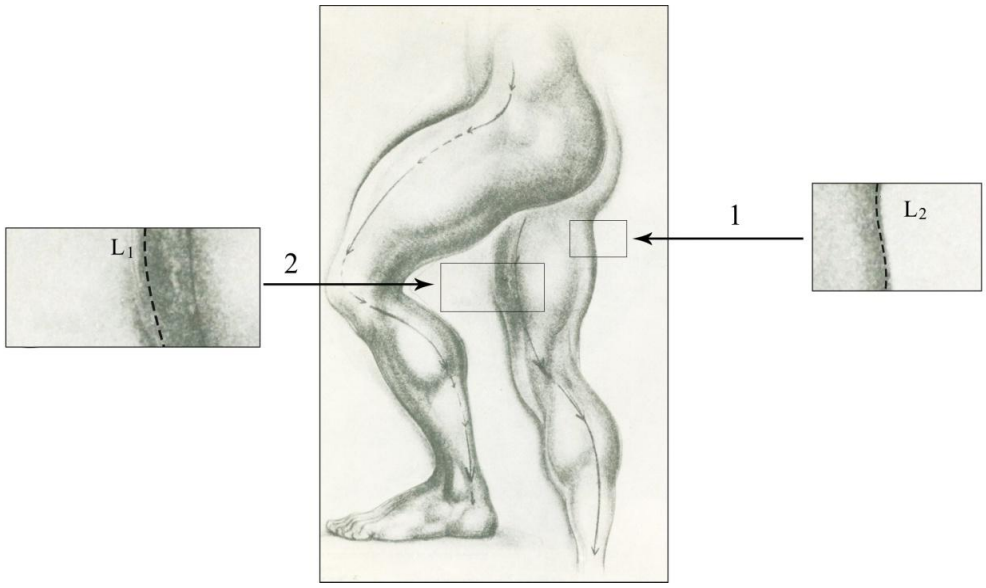

Fig. 27. Figure Drawing by Ben Hogwarts

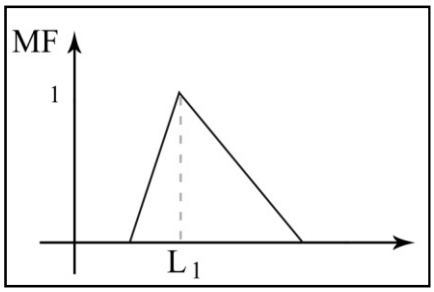

Fig. 28. The meaningful function of section 2

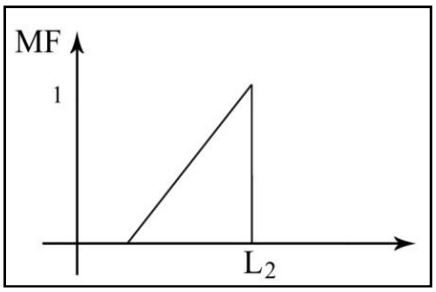

Fig. 29. The meaningful function of section 1

Note: Here it is necessary to emphasize that the choice of darkness criterion to construct a meaningful function is a propositional criterion to show how the ideas of this article work. In criticizing the artwork, any other subjective, verbal or physical criterion can serve as a basis for constructing a meaningful function to analyze the desired artwork.

Note: Given the capacities of the mathematical definitions, the definitions we present in these papers and what we said about the meaningful line in the first paper, the imaginable forms for a meaningful line are very diverse and meaningful that can add new capacities in the future to visual arts. We are currently working on the basis of alpha cuts of these definitions, and the artworks mentioned are not, in the perfect sense, an example of a fuzzy artwork, but some of the sections of them are indicative of the existence of fuzzy thinking in the works of the earlier artists, which gives us a great hope for the development of fuzzy thinking in visual arts.

6 Conclusion

Throughout the history of art, attention to structural and formal issues has always been important in fields such as the teaching methods of art and critique and the study of the form of artwork. Following the prior papers, in this article, we have been looking at the production of a common language for dialogue and analysis in the abovementioned fields, in which the common language protects the individual characteristics of modern and contemporary art while including classical art at the same time. In this regard, we define the meaningful contour and present examples of the author's minds to provide the necessary tools for meaningful formal critiques in the future works.

Competing Interests

Author has declared that no competing interests exist.

References

[1] Belohlavek R, Dauben JW, Klir GJ. Fuzzy logic and mathematics: A historical perspective; 2017.

[2] Kosko B, Fuzzy thinking: The new science of fuzzy logic; 1999.

[3] Asian M, Meaningful forms and fuzzy geometry I: MPB & MGP. ARJOM; 2018.

[4] Asasian M, Meaningful forms and fuzzy geometry II: Meaningful surface & "Meaningfully Flat" Criterion. ARJOM; 2018.

[5] Bell C, Art as significant form. Aesthetics: A critical anthology. Dickie G, Sclafani RJ. (eds), New York, St. Martin's Press; 1977.

[6] Fry R. Transformation: Critical and speculative essays on Art. Chatto & Windus, London Press; 1926.

[7] Wolheim R. On formalism and its kinds, Barcelona. Fundació Antoni Tàpies; 1994.

[8] Greenberg C. Feeling is all, Partisan Review; 1952.

[9] Tatarkiewicz W. Form in the history of aesthetics. Dictionary of History of Ideas P. (ed). New York, Charles Scriber's Sons; 1968.

[10] Kant I. Critique of Pure Reason. Bernard JH. (ed). New York, Hafner Press; 1951.

[11] Rosenfeld A. The diameter of a fuzzy set. Fuzzy Sets and Systems . 1984;13:241-246.

[12] Rosenfeld A. Fuzzy rectangles. Pattern Recognition Lett. 1990;11:677-79.

[13] Rosenfeld A. Fuzzy plane geometry: Triangles, in Proc. 3rd IEEE Internat, Conf on Fuzz)' Systems, Orlando, 26-29. 1994;11:891-893.

[14] Rosenfeld A, Haber S. The perimeter of a fuzzy set, Pattern Recognition . 1985;18:125-130.

[15] Buckley JJ, Eslami E. Fuzzy plane geometry I: Points and lines, Fuzzy Sets Syst. 1997;86:179-187.

[16] Buckley JJ, Eslami E, Fuzzy plane geometry II: Circles and polygons, Fuzzy Sets Syst.1997;87.79-85.

[17] Ghosh.D, Chakraborty D, Analytical fuzzy plane geometry I, Fuzzy Sets Syst. 2012;209:66-83.

[18] Ghosh D, Chakraborty D. Analytical fuzzy plane geometry II. Fuzzy Sets Syst; 2013.

[19] Ghosh D, Chakraborty D. A study on a parametric form of a fuzzy line, Uncertainty in Mathematics. 2013;1-11.

[20] Asasian M, An introduction to expressionism analysis based on meaningful deformation current. Journal of Applied Science and Technology; 2018.

Peer-review history:
The peer review history for this paper can be accessed here (Please copy paste the total link in your browser address bar)
http://www.sciencedomain.org/review-history/25753