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# Metaphorical Parametric Model for Brand Mark Design

## Towards a Universal Model of Computational Visual Communication Design

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ABSTRACT

Visual communication design involves two aspects of visual representation, namely, information and expression. The goal of building a computational model for visual communication design has existed for many years. However, this objective is only partially fulfilled as most of the solutions are focused on the aspect of information and seldom touch upon the expression. Lakoff and Johnson claim that "…metaphor is not just a matter of language, …, human thought processes are largely metaphorical." Thus, based on the theory of conceptual metaphor rather than language, a computational model for visual communication is proposed. As brand mark design is a challenging problem that demands the representation of both information and expression, the first attempt of the development of this new model is targeted to brand mark design. The assembling of MPM is based on the Metaphorical Relation (MR), which manages the spatial arrangement of its components to signify the intended meanings. All components and relations of the MPM are parametrically controllable for generating infinite visual forms to represent different kinds of information and expression.



## 1. Introduction

The idea of formalising visual communication design as a model of visual language has been carried out by art and design practitioners for many years. In general, there are two major groups of practitioners—the informationists Neurath, Bertin, Richards and Engelhardt [1, 2, 3, 4, 5] and the expressionists Kandinsky and Klee [6, 7, 8]. Brinton [1] stated that: "The principles for a grammar of graphics presentation are so simple that a remarkably small number of rules would be sufficient to give a universal language." With the advent of computing, his idea of making a universal visual language for graphic representation has been partially fulfilled. However, most of the previous research works are limited to the presentation of quantitative information such as variable data printing [9], automatic layout [10], font matching [11] or data visualisation [12]. Although there are some attempts to create algorithms for showing expressions in generative art [13, 14] or generative design [15, 16], they are mostly focusing on the synthesis of visual forms but not generate works based on the creative concepts or the semantic meanings. Yet, there is no well-established universal model to represent both information and expression.

As an attempt to create a universal computational model which can generate designs to present information as well as expression, this paper proposes the Metaphorical Parametric Model (MPM) for generating visual communication design. Since brand mark design is related to both information and expression and has been considered as "one of the most difficult to perfect [17]", it is chosen as the topic for an initial attempt.

This paper is organised as follows: Section 2 outlines the theoretical framework of the MPM. Section 3 reports the corpus analysis of 8000 brand marks and explains how the findings are utilised for the development of the model proposed. Section 4 presents the model of Metaphorical Parametric Model (MPM) and discusses how to represent visual objects for making metaphorical expressions. Section 5 introduces the concepts of Metaphorical Relations (MR) and Metaphorical Expressions (ME).

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Section 6 demonstrates how to use the MPM to recreate an existing brand mark. It also discusses how to change the MR or the components of the MR to generate new designs. Section 7 further discusses the concept of MPM and related issues. Section 8 concludes this paper and suggests future developments.

## 2. Background

In the following paragraphs, the theoretical framework of the MPM is introduced and described. Five principal theories which are essential to the construction of this model are introduced, including the conceptual metaphor, image schema, primary metaphor, visual rhetoric, and symmetric object alignment.

### 2.1 Conceptual Metaphor—the Foundation of Language

In their seminal book "Metaphors We Live By", Lakoff and Johnson state that, "…metaphor is not just a matter of language, …, human thought processes are largely metaphorical.". [18, p. 3] Based on such premise and many examples elucidate in the book, they further confirm that "Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature [18, p. 153]." They define that conceptual metaphors are different from the linguistic ones but specific cognitive concepts embedded in our bodily experience. Based on the nature of the source domain of the mapping, they differentiate three types of conceptual metaphors, namely, ontological, structural, and orientational metaphors.

1. **Structural metaphor:** This type of metaphor is grounded in systematic correlation within our experience in which the concept is expressed with another different structured, clearly defined or well familiar concept. For example, the same structure of war can be used as the metaphorical expressions "ARGUMENT IS WAR". Therefore, the concepts such as attack, indefensible, strategy, win, gain, ground and related concepts will be used to form a systematic way of talking about the battling aspects of arguing.
2. **Orientational metaphors:** In this type of metaphor, the mapping is focused on adopting the structure of one concept rather than a whole system of concepts of the corresponding object. Most of these are related to spatial orientations such as up-down, in-out, front-back, on-off, deep-shallow, or central-peripheral related to the physical environment. Hence, the orientational metaphor represents a spatial orientation concept such as HAPPY IS UP and results as an expression like "I'm feeling up today."
3. **Ontological metaphors:** The concept of this type of metaphor is based on the mapping of a source in the physical world to the target which can be an activity, emotion or idea. Take the "INFLATION IS AN ENTITY" as an example, by using "inflation" as an entity, it allows us to quantify, identify it, take it as a cause and act upon it as the "Inflation is lowering our standard of living" or "Inflation is hacking us into a corner."

In summary, the conceptual metaphor theory provides at least two fundamental concepts of the MPM proposed here. First, it states that our conceptual systems are based on conceptual metaphors rather than languages. Second, metaphorical expressions are constructed with a system through the mapping of meanings from the source concepts to the target concepts.

### 2.2 Image Schemas — the Recurring Patterns of Embodied Experience that Structure Our Concepts.

The term "image-schema" is only briefly mentioned in "Metaphors We Live By" [18] and the more in-depth discussions are found in the later publications [19, 20, 21, 22, 23]. Johnson [20] explains that the idea of a close connection between perceptual and semantic structure is not new and have been discussed by scholars such as Dewey, Merleau-Ponty and Churchland. By using the formation of the CENTER-PERIPHERY image schema as an example, he describes that once a baby is born, it will develop its visual focusing abilities gradually. It learns to focus on an area and highlight a figure against a background that fades out into an indefinite perceptual horizon on its periphery. In order to survive, animals must acquire such focusing skill and know that the centre part is more important than its periphery. Such perceptual experience always reveals the same recurring schematic structure which has a focal centre surrounded by a horizon that fades off. The CENTER-PERIPHERY structure, as well as many other image schemas, is not restricted to vision but relevant to all our senses. When our focus is confined to the voice on the telephone, our attention will be diverted away from the humming noise from the computer nearby. On the other hand, we can shift the focus and take the voice as periphery and make the humming noise as the centre.

The CENTER-PERIPHERY schema is critical to our fundamental preconceptual understanding of our world. It is a continuous structure or pattern through which we organise and unify our perceptions, motor programs, spatial orientation temporal sequences and so forth. An image schema is not an abstract, finite proposition, concept or concrete image but an evolving pattern of our imaginatively structured experience. It is a recurrent pattern which comes from our bodily (sensorimotor) experience of the world. Through different types of image schemas, we can connect different perceptual phenomenon

and our understanding of more abstract domains through imaginative metaphoric and metonymic projections.

### 2.3 Spatial Primitives—the Prelinguistic Conceptual Building Blocks

Through a long period of study of the development of the conceptual system of baby, Mandler [24, 25, 26, 27] makes noteworthy interpretation of the principle of image schema from the perspectives of developmental psychologist rather than those of the cognitive linguistics. She argues that concept formation is top-down in nature and organised as a hierarchical object conceptual system. The early conceptual categorization of objects are not refined and it is difficult for infants or even adults to define conceptual categorization of objects such as dog or vehicle. Thus, she proposes the attentional processes for the formation of the first concepts, by finding patterns in perceptual data and redescribing (reformatting) them. She states that "Initially, redescription is done via the conceptual primitives that are the vocabulary of the mechanism (called Perceptual Meaning Analysis) that does the reformatting. This mechanism is an attentive process that extracts spatial information from perceptual displays and while retaining its analogue character recodes it into a skeletal (somewhat topological-like) form. For example, the infant attends to an apple being put into a bowl, but Perceptual Meaning Analysis outputs something like thing into a container. Redescriptions like this enable the concept formation that makes conscious thought possible." [24, p. 212]

Mandler further highlights that the early global concepts are mainly related to spatial information, especially movement in space which she calls "conceptual primitives". This spatial information is primarily related to concepts of both objects and events which is different from the other non-perceptual schema such as force schemas. So, the "container" primitive has a bounded space with an inside and an outside. The "linked paths" primitives consist of objects moving together collectively. For Mandler, these primitives are not merely copies of sensory impressions but require descriptive processing before the perceptual encoding is transformed as the conceptual descriptions. Based on the principle just mentioned, she considers that spatial image-schemas should be differentiated from the other conceptual representations.

Though the term "prelinguistic primitive" [25] has been used in the early article in her discussion of the human conceptual system and image schema, in the later one, Mandler [27, pp. 510–511] suggests that "Spatial primitives are the first conceptual building blocks, image schemas are simple spatial stories built from them, and schematic integrations use the first two types to build concepts that include non-spatial elements. These three kinds of structure and some others as well have often come under the umbrella term of 'image schemas'."

She explains that spatial and motion primitives are essential to the first image schema. It lets the infant simplifies the situations and find a way to understand and remember the events; so, they can form new conceptual structures by unifying different sensations and feelings of force. However, Mandler suggests that the term "image schema" is different from these new structure and should be limited to imageable information, which constitutes the foundations of the conceptual system. The term 'schematic integrations' should be used to represent the other structures that include internal feelings of force, the other emotions and sensory information. So, starting with spatial primitives, infants can construct image schema to run mental simulations of spatial events. Then, based on these simulations, they can connect disparate experience and integrate them into new conceptual structures and create schematic integrations which eventually composed with more non-spatial elements. When the non-spatial, non-imageable information is incorporated into the conceptual system, she considers that these structures are no longer image schemas anymore but are blends that integrate non-spatial components into spatial events. They also allow the infants, for the first time, to conceptualise non-spatial experiences as meaningful aspects of organised spatial stories.

Finally, Mandler concludes that "All three structures of the schematisation process (spatial primitives, image schemas, and schematic integrations) are powerful tools for reducing the immense variety of perceptions and sensations to discrete kinds of event that the human mind can easily represent." [26, p. 19]

### 2.4 Metaphor and Image Schema in Information Visualization

Image schema is now well accepted and the concept has been confirmed by research in cognitive sciences and developmental psychology [21, 22, 23]. Risch [28] lists as many as sixty-six image schemas and explains that many information graphics are based on the principle of image schema whereas people's early perceptual experience of spatial relations such as "containment", "path-following" and "object dynamics" become generalised and formalised subconsciously. He makes a comprehensive discussion on the use of image schema and metaphor for the visualisation of information. He describes that there are two distinctive types of graphics namely analogical graphics and metaphorical graphics:

1. **Analogical graphics:** It depicts the inherent spatial relations from the source to the target of the same domain such as the mapping of the length of line to a dimension.
2. **Metaphorical graphics:** It expresses non-spatial concepts in spatial terms through the functional alignment with image schemas.

He proposes [28, p.2] that '…the standard inventory of image schemas derived from linguistic and cognitive studies can serve as the basis for developing a kind of visualization "grammar." Such a grammar would employ graphical analogues of image schematic patterns as syntactic elements that relate concepts expressed using conventional signifiers such as text, colour, and symbology.'

## 2.5 Primary Metaphor—the Basic Components of Complex Metaphor

Grady [29] suspects that if a metaphor is a conceptual rather than a linguistic phenomenon, it should be revealed in the other cognitive behaviours which have been supported by various researches [30, 31]. To investigate the related questions, he proposes a new approach to conceptual metaphor as Figure 1. For Grady, primary metaphors refer to bindings of this type of distinct concepts emerged from primary scenes as described in the figure whereas the conceptual mapping of this type constitutes the patterns of metaphoric language.

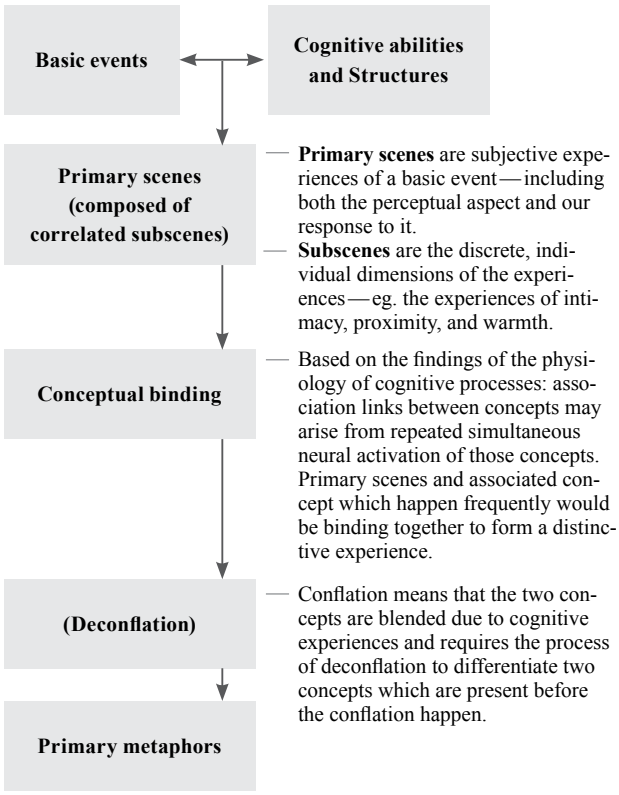



**Figure 1: From basic events to primary metaphors with descriptions [29]**

Grady argues that primary source concepts should be universal with basic properties, relations and activities came from our experience of the world. A typical characteristic of the primary source concepts is that they have image content represented as a mental image which is multimodal and not limited to vision. Contrarily, primary target concepts lack image content or sensory content; they are not the direct perceptions of the world but responses. Target concepts like "similarity", "happen", and "difficult" are merely universal cognitive operations and structures.

Therefore, based on the principle mentioned above, Grady specifies the primary metaphor as follows:

| | |
|---|---|
| Metaphor: | SIMILARITY IS PROXIMITY |
| Motivation: | The tendency for similar objects to be clustered together.<br>And /or the tendency for adjacent objects to appear similar because of they are in similar conditions. |
| Examples: | These fabrics aren't quite the same but they're close.<br>His singing style is miles away from mine. |

Furthermore, he also compiles a list of primary metaphor and categorised as five groups as shown in Table 1.

**Table 1: Categories of Primary Metaphor**

| Category | Count |
|---|---|
| Atemporal relations | 19 |
| Quantity and degree | 4 |
| Time, action and event structure | 28 |
| Affect, evaluation and social relations | 28 |
| Thought and consciousness | 21 |

Once Grady has proposed the concept of primary metaphor, he argues that there are many other more complicated conceptual structures which are based on primary metaphors and can be constructed through the process of conceptual binding. For example, the complex metaphor "VIABLE COMPLEX ENTITY IS ERECT PHYSICAL STRUCTURE" can be deconstructed as "VIABILITY IS ERECTNESS," grounded in our experiences with objects where erectness correlates with functionality and health. Furthermore, "ORGANIZATION IS PHYSICAL STRUCTURE" is grounded in the manipulation of complex objects, which correlates with the formation of mental representation of logical relationships among parts. Both of these basic metaphors come from our experience with physical objects in the world and each of the two primary metaphors focuses to a specific part of our experience with objects while they could happen concurrently. Thus, a viable entity stands up firmly as a building which is an erect physical structure and constitutes the compound metaphor "VIABLE COMPLEX ENTITY IS A BUILDING."

Grady states that the theory of primary metaphor simplifies the construction of metaphor by distributing the process to a set of fundamental modules rather than dealing with many complicated matters at once. By deconstructing a complex metaphor into primary metaphors, it becomes easier to understand the underlying concept of each metaphor. At the same token, it provides a set of basic components which could facilitate the construction of complex metaphor for different purposes. Such a principle not only valid for the linguistic metaphor but also a useful strategy to keep visual metaphor universal if the underlying principles could be utilised by users of different backgrounds.

## 2.6 Integrated Theory of Primary Metaphor

After more scholars have investigated on the studies related to conceptual metaphor, Lakoff and Johnson [19] propose the Integrated Theory of Primary Metaphor which provides some complementary principles to support the understanding and utilisation of the theories of conceptual metaphor and primary metaphor. This integrated theory consists of four parts, namely, Johnson's theory of conflation in the course of learning, Grady's theory of primary metaphor, Narayanan's neural theory of metaphor, and Fauconnier and Turner's theory of conceptual blending and each of these theories are described as follows:

1. **Johnson's theory of conflation in the course of learning:** Young children may not be able to distinguish the subjective (non-sensorimotor) experiences and judgments and sensorimotor experiences and regularly conflated them if they occur together at once for a time.

   An infant may make a connection between the subjective experience of affection with the sensory experience of warmth during childhood. The association of two different domains are automatically and repeatedly connected and eventually leads to conflation. However, the children can separate the domain during a period of differentiation while the cross-domain associations are still maintained. This persisted mapping of conceptual metaphor leads the same infant to associate affection with warmth and making the metaphorical expression "a warm smile" or the sense of being help closely as "a close friend" later in life.
2. **Grady's theory of primary metaphor:** According to Grady, primary metaphors are the "atomic" components which can be used to construct complex metaphors like "molecular" structures. Through the recurring process of conflation which makes cross-domain association occurred and gives rise to primary metaphor, universal early experience of conflation eventually lead to conventional conceptual metaphor.
3. **Narayanan's neural theory of metaphor:** During the process of conflation, the associations are realised neurally in simultaneous activation. A neural network that defines the conceptual domains will result in permanent neural connections within the brain.
4. **Fauconnier and Turner's theory of conceptual blending:** In certain cases, different conceptual domains can be activated together and form cross-domain connections. Such "conceptual blends" can be original or conventional while two or more primary metaphors can be combined to make larger complex metaphors through the mechanism of conventional blends.

Lakoff and Johnson summarise that there are hundreds of primary metaphors come from our experiences repeatedly. Through conflation and deconflation, people formulate a rich inferential structure and shape the neural network they have. Narayanan's neural theory of metaphor explains how primary metaphors are formed and operates due to our embodied experience of the world. They make many sensorimotor experiences become the resources for metaphorical extension and functions as the components for building complex metaphor.

## 2.7 Different Opinions on the Conceptual Metaphor Theory

Throughout many years of its development, the Conceptual Metaphor Theory (CMT) has received different criticism and gone through different levels of refinements. Szwedek [32] criticised that structural and orientational metaphors are based on existing objects, thus metaphors are ontological. All non-physical phenomena such as social, political phenomenon as well as events, actions, activities and states have to be objectified first before they can be assigned structure and orientation. On the other hand, Hernández and Pérez, [33] argued that metaphor is not fundamentally ontological as explained by Lakoff and Johnson [18], image schema and primary metaphor are more fundamental.

In a special issue of the retrospective of conceptual metaphor, Fusaroli and Morgagni [34] mentioned that some authors such as Leezenberg [35] suggested that embodied concepts do not come from an individual's experience only but largely shaped by the social, cultural and linguistic practice. Regarding the influence from society and culture, Brandt [36], Deignan and Cameron [37] pointed out that the conceptual metaphor is not all dependent on bodily experience but conditions affected by the context. All these lead to the direction that the CMT should concern with the conceptual patterns affected by cultural practices and contextual issues. Based on studies of different researchers, plenty of evidence [38, 39, 40] reveals that people understand certain domains through the other domains more often than through the language. People talk and think about time in term of space and motion but not from the opposite direction.

## 2.8 Visual Rhetoric—the Means to Manipulate Visual Presentation

Marcus [41] states that: "Visual rhetoric refers to those devices which modify or affect a viewer's conceptions and attitudes toward a visual presentation." Among the early studies of visual rhetoric, Bonsiepe [42] and Durand [43, 44] have provided concrete guidelines and trigger the awareness of visual rhetoric among the practitioners in the design and advertisement industries. Through the examinations of different taxonomies of visual rhetoric [45] proposed by different researches, the framework offered by Durand has been identified as the most applicable one for the objective of the current study. The matrix of "Classification of Figure" presented by Durand as shown in Table 2 provides a rather structural approach to construct different types of visual rhetorical figures. This matrix is organised with the "rhetorical operations" assigned to the horizontal axis and the semantic relations assigned to the vertical axis. Then the cell corresponds to the intersection between the horizontal row and vertical column indicates the rhetorical figure resulted from the interaction of the rhetorical operations and the semantic relations. The concepts of the rhetorical operation listed on the horizontal axis are as follows:

- Addition: one or more elements are used in the composition
- Suppression: one or more elements are deleted from the composition
- Substitution: it can be formed by a suppression followed by an addition. So part of the components are removed and the other components will be added to the composition.
- Exchange: it consists of two reciprocal substitutions in which the two substitutions are inversely related.

Regarding the relations between objects, Durand has distinguished the objects by the nature of either "similarity" and "dissimilarity". Between two elements, he indicates different relations between form and content in Table 2. The definitions of the label in the matrix are as follows:

- Identity: only relations of identity
- Similarity: at least one relation of identity and one of difference
- Opposition: at least one relation of opposition
- Difference: only relations of difference
- Paradox and double meaning are mix relations of content and relations of form. The relations of content are first seen as homologous to the relations of forms; however, comprehensive examination reverses this interpretation.

Based on the interactions of different relations, Durand proposed the complete set of rhetorical operations as shown in Table 2. This schematic approach provides an effective way to construct visual rhetoric that seems to match with the traditional rhetorical figures as listed in the matrix. Such an approach also provides a useful exemplar to construct a system of visual rhetorical operations to work with the computational model proposed in this study. However, the relations of forms and relations of elements listed in Table 3 are much more complicated than the descriptions in his paper as a form could refer to either the physical form or the linguistic form. Furthermore, a form or element has different attributes such as material, colour, texture, size, and shape which can affect the meanings as well. After all, when the verbal rhetoric is transferred to visual rhetoric, the limitation of the current understanding of visual rhetoric becomes obvious and reflects that additional knowledge beyond those of verbal rhetoric is required.

**Table 2: Classification of Figure [43]**

| Relations between Elements | Rhetorical Operations | | | |
|---|---|---|---|---|
| | ***Addition*** | ***Suppression*** | ***Substitution*** | ***Exchange*** |
| ***Identity*** | Repetition | Ellipsis | Hyperbole | Inversion |
| ***Similarity*** | | | | |
| ***of form*** | Rhyme | | Allusion | Hendiadys |
| ***of content*** | Simile | Circumlocution | Metaphor | Homology |
| ***Difference*** | Accumulation | Suspension | Metonymy | Asyndeton |
| ***Opposition*** | | | | |
| ***of form*** | Zeugma | Dubitation | Periphrasis | Anacoluthon |
| ***of content*** | Antithesis | Reticence | Euphemism | Chiasmus |
| ***False homologies*** | | | | |
| ***Ambiguity*** | Antanaclasis | Tautology | Pun | Antimetabole |
| ***Paradox*** | Paradox | Preterition | Antiphrasis | Antilogy |

**Table 3: Interaction of Relations of Form and Content [43]**

| Relations between Elements | Relations of form | | |
|---|---|---|---|
| | ***Identity*** | ***Difference*** | ***Opposition*** |
| ***Identity*** | identity | similarity of content | paradox |
| ***Difference*** | similarity of form | difference | opposition of form |
| ***Opposition*** | double meaning | opposition of content | homologous opposition |

When Durand [43, 44] first introduced the theory of visual rhetoric in 1970, the theory of conceptual metaphor had not emerged yet. So during that period, the use of visual rhetorical figures was mainly based on the intuition of advertising people who select objects to symbolise the meaning that they would intend to express. Such know-how based on intuition and common practice prevail in the advertising and design industries for many years. Most of the time, the practitioners may consider the making of visual rhetoric as a kind of creative act emerging from their imaginations without noticing the underlying theories. In the current study, through the integration of the theory of Durand and the other theories introduced in this section, it reflects that conceptual metaphor and rhetoric are crucial for communication. However, visual rhetoric is different from verbal rhetoric and a different theory should be developed for visual communication and the related issues will be discussed in Section 7.

## 2.9 From Conceptual Metaphor Theory to Visual Rhetoric and Symmetric Object Alignment

By the time when the researchers in the marketing and linguistic studies notice the connection between the visual rhetoric and conceptual metaphor, the component which binds all the theories mentioned above finally emerged. Schilperoord, Maes, and Ferdinandusse [46] describe that people tend to organise objects as cohesive configurations according to the century-old gestalt theory [47]. Hence, designers often deliberately utilise these grouping principles for their aesthetic and expressive purposes. The making of visual expressions through the manipulation of metaphorical relations and mapping of concepts between visual objects is defined as symmetric object alignment (SOA).

Through the incorporation of the theory of primary metaphor and SOA in visual representations, Ortiz [48] explains that the formal configuration of visual metaphor in pictorial advertising could be distinguished as three types as shown in Table 4. The first type can be regarded as a fusion in which different objects are blended together and appear as a single hybrid image. The second type appears as an omission in which only one single object is shown while the other is hidden and suggested by the context. The third one can be considered as a juxtaposition which shows at least two objects at once.

**Table 4: Three Basic Types of Visual Metaphors**

| Type | Logo Sample | |
|---|---|---|
| Fusion: Blending of different objects in a hybrid image |  |  |
| Omission: Only one object appears and the other is suggested through the context |  Food Company |  Child, Infant's Product Company |
| Juxtaposition: Both objects appear simultaneously |  |  |

Concerning the nature between the objects chosen for the alignment, they could be categorised as three different types including the alignment of different objects, the alignment of incompatible objects, and the alignment of identical objects.

Based on various combinations of the formal structures and the selected objects, Ortiz has analyzed a series of advertisement and identified five types of primary metaphors generally found in advertisements which include:

- "SIMILARITY IS ALIGNMENT"
- "SIMILARITY IS PROXIMITY"
- "THE NATURE OF AN ENTITY IS ITS SHAPE", "CONSTITUENTS ARE CONTENTS"
- "CATEGORIES/SETS ARE BOUNDED SPATIAL REGIONS"

Ortiz summaries that the nature of SOA could be either metaphorical or literal. The SOA is metaphorical when the object conveys the idea of similarity and belongs to the same category; also, when the alignment, proximity, shape, inclusion, and space indicate the presence of primary metaphors which are grounded by experiences. The SOA is literal if the element presented does not seem similar but merely shows objects different from the others.

The examples provided by Ortiz show that SOA can be utilised in various kinds of visual rhetoric to construct visual metaphor for making metaphorical expressions. Although her study focuses on the discussion of

advertisings and photographic images, the same principle of SOA could be found in brand mark design as reflected in the results of the corpus analysis described in next section. However, as the structure of visuals is different from text, different approaches of using SOA are necessary for the development of visual languages and the related issues will be further discussed in the later sections.

## 3. Corpus Analysis of Brand Marks

Pragglejaz Group [49] proposes the "metaphor identification procedure" (MIP) for identifying the metaphorically used words in discourse. They describe that different researchers will handle the material and process differently based on their purpose whereas some may do a large corpus while the experimental psycholinguists may only verify or identify the target words or discourse in small sources.

For this study, due to the nature of the corpus is visual form rather than text, the corpus analysis demands the judgement of human other than the processing of computers. Thus, under the constraint of time and resource, a flexible and pragmatic approach is adopted. The process focuses on two key issues including:

- The identification of the basic components and structures of brand mark designs.
- The identification of the use of the conceptual metaphor and visual rhetoric in the brand mark design.

Two sets of books [50, 51] with collections of approximately 8000 brand marks were chosen. Though one of the publishers of these books is from Japan while the other is from South Korea, the samples in the collections are selected from worldwide. In general, these type of books are used by designers for reference, most of the samples in the collections were well selected by editor with design expertise. Hence, the samples in these collections consist of the choice of two different groups of experts who would screen for professional-grade design samples. Those digital files distributed with the book is another crucial factor to consider the choice of these collections. Thus, all the brand marks can be loaded into the database for the corpus analysis without extra preparation work beforehand.

Two fresh graduate design assistants had been assigned to identify the shapes and objects found in each sample. All the shapes found in the samples were deconstructed and identified as one or more of the shapes listed in the codebook which was compiled according to literature reviews. During the process of the corpus analysis, if any shape extracted from the mark could not be classified as a shape listed in the codebook, the new item would be added to the codebook until all the unique shapes were recorded. The objective of this task was to identify the essential set of shapes required for brand mark design. Other than the basic geometric shapes, the assistants had to identify and record the objects represented by these basic shapes.

Here, the basic shapes are defined as the simple, primitive forms found in brand marks, they may or may not resemble any object found in reality. However, these forms mostly appear as geometric shapes or distinctive shapes which can be represented by equations. These objects can be either physical entities or graphic representations; also, they can be either natural or manmade objects. Thus, two small circles on a circle might signify a human face as Figure 2 when they are reading as a single object. On the other hand, the same configuration can be considered as two small circles overlay on the front layer of a larger circle if they are perceived as separated shapes. In both of these cases, both the circle and human face will be an entry as shape and object respectively.

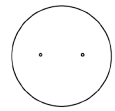


**Figure 2: Two dots enclosed in a circle, forming a human face**

From the result of the analysis, certain distinctive patterns are noticeable and part of the findings are listed and discussed as follows:

**Table 5: Summary of the Brand Mark Analysis**

| Item | Count | |
|---|---|---|
| Total number of brand marks analysed | 8095 | |
| Total Object count | 23738 | |
| Unique object identified | 1538 | |
| Geometric Shapes | 11784 | (49.65%) |
| Organic Shapes | 1195 | (50.35%) |

As Table 5 shows above, nearly half of the shapes in the corpus are abstract forms and mostly can be considered as geometric shapes. These brand marks may consist of one or more components which may appear as abstract forms, iconic objects or a combination of both. The findings reflect that both geometric and iconic shapes are essential for brand mark design. Since geometric shapes do not depict specific objects but are usually perceived as abstract forms, they can be used as components of design to represent a wide range of objects or topics. In many cases, it is the composition and arrangement of these objects that constitute the meaning of the brand marks. The figure listed above indicates that without using complex forms or many diversified objects, it is possible to generate a large variety of brand marks in the collections with

a small set of objects using geometric shapes.

Since the top hundred of the most used objects count for 67% of the items in the corpus, the corpus analysis has focused on this set instead of processing thousands of objects for efficiency. In the second phase, these marks have gone through further analysis for identifying their synthetic and semantic structures. As the meanings of visual objects are affected by the conditions, contexts and cultures, the annotations done by the assistants might not be precise and comprehensive due to their experience and background. However, because of this analysis is not aimed for making an exhaustive study of the corpus but rather a strategy to identify how meanings are signified in brand marks regarding the theory of conceptual metaphor and visual rhetoric. So, even though this corpus analysis has its limitations, it provides the idea and knowledge to build computational models for making visual expressions.

The result of the corpus analysis indicates that the objects used in the brand mark designs consist of either iconic or abstract forms. These designs may appear as a single or more items in which several basic components could be combined as an abstract or iconic object. Thus, based on the background theories described in the earlier sections and the result of the analysis just mentioned, the current study proposes a new model to generate brand mark designs.

## 4. Introduction of the Metaphorical Parametric Model (MPM)

Metaphorical Parametric Model (MPM) is a type of two-dimensional model designed for making visual metaphorical expressions based on conceptual metaphor theory and visual rhetoric. Instead of representing the synthetic structure of a specific object, it represents the semantic structure and the semantic relations in between. Moreover, the synthetic process of MPM is guided by its semantic components. Thus, through different combinations of parametric settings of the MPM, different forms could be generated to signify diversified meanings ranged from literal representation to metaphorical expression.

### 4.1 MPM Types

MPM consists of two different types of basic entities namely element and compound. An element is a single, simple and distinctive visual object while a compound is composed of two or more components which could be either an element or another compound.

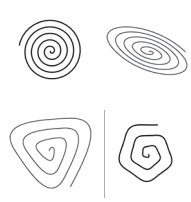
### 4.2 Elements and Metaphorical Properties

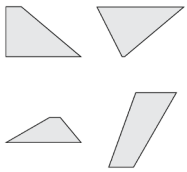
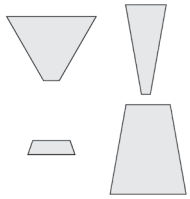
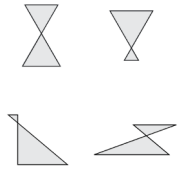
Based on the analysis of the samples, approximately sixty primary components are encoded as the "elements" of the MPM currently. An element is the most common and essential form found in a specific domain such as the brandmark in the current study. It is a simple, abstract, and geometric-like two-dimensional object generated by certain geometric logic and equations while each form is controlled by one or more parameters. Elements can be classified as two types, namely line and shape. The major difference between them is that a line is defined as an open path without an enclosed area. However, both types could suggest different expressions according to the art and design theories introduced by Kandinsky and Klee [6, 7, 8].

Among all graphic forms, both lines and shapes could trigger cognitive responses. Through experiments with the imaging from fMRI, Larson, Aronoff, Sarinopoulos and Zhu [52] recognise that the data support the notion that visual threat can be triggered by a simple downward V-shape with no reference of the other contextual or affective cues. Besides, the tests of the association of meaning between the downward-pointing and upward-pointing triangles also support the hypothesis that simple geometric forms could convey emotions. Thus, the results support that our brains could detect the stimulus of the geometric shapes with much less stimulus information than the earlier studies of these authors [53].

Regarding the semantics of lines and shapes, findings done by researchers such as the studies of lines by Ibáñez and Delgado-Mata [54] and the studies on shape by Blazhenkova and Kumar [55] could provide guiding principles to set the parametric settings of the MPM for signifying the intended expressions. Thus, as indicated in Table 6, with different parameters, a single element such as the Archimedean Spiral or Trapezium could suggest a multitude of expressions as listed.

**Table 6: Generated Forms of Various MPM and Their Possible Metaphorical Expressions**

| **Archimedean Spiral** | | | | | |
|---|---|---|---|---|---|
| ***Regular*** | | ***Offsetted*** | | ***Outward*** | |
|  | | | | | |
| ***Possible Metaphorical Expressions (Respectively)*** | | | | | |
| regular | harmony | graceful | living | springy | dynamic |
| hypnotic | gentle | organic | biological | cheerful | changing |
| cryptic | intricate | nature | structural | extroverted | unexpected |
| mysterious | infinity | exquisite | dynamic | excited | energetic |

| Trapezium | | | | | |
|---|---|---|---|---|---|
| *Asymmetric* | | *Large width/ hight ratio* | | *Complex* | |
|  | |  | |  | |
| ***Possible Metaphorical Expressions (Respectively)*** | | | | | |
| free-spirited | distinct | structured | precise | opposing | focused |
| unrestricted | individual | geometric | absolute | conflicting | against |
| open | intentional | dignified | strong | complicated | difficult |
| independent | anarchic | historic | bold | contradict | agitated |

## 4.3 Compounds

A "compound" of MPM is a two-dimensional visual object formed by two or more components assembled with specific relations. The component of a compound can be either an element or another compound. A compound only provides two or more semantic placeholders for holding objects; it has no definite synthetic form other than connected together by a set of conceptual relations controllable by parameters. In general, a set of default parametric settings which matches with the general knowledge of most of the people will be assigned to the initial form of the compound.

When different parameters or objects are assigned to the compound, the results could be quite distinct from the default settings. Figure 3 is the conceptual diagram of the compound "sun". and the top right version in Figure 4 is the "sun" generated with the default settings. With different parameters used in the other versions, even without changing the objects assigned to the placeholder, the other variants in Figure 4 become quite departed from the default version.

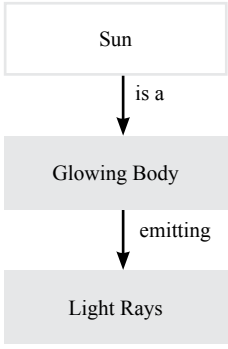



**Figure 3: The conceptual structure of compound "Sun"**

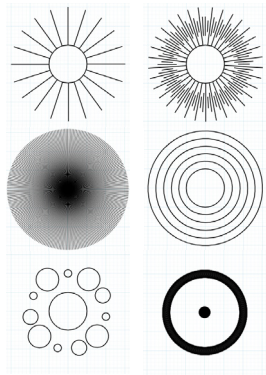


**Figure 4: Sun generated with different parameters**

As the components and the parameters in the compound "sun" can be switched according to the intended semantic meaning, it can be used to construct different design as shown in Figure 5 and 6 in which the concept of the sun is still retained but the visual forms and expressions are different.


**Figure 5: Existing brand marks recreated using compounds "sun" on the right, original design on the left**

**Figure 6: The other existing brand marks that could be represented by the compound "sun"**

## 4.4 Deconstruction and Construction of Compounds

To create a compound, the target object should be deconstructed as the relevant units and reconstructed as a conceptual structure matched with the general knowledge of most of the people or the target audience. Depending on the background, cultures or shared experiences, different people may have different concepts of the structure of the object. In additions, as the focuses or viewing angles towards the same object could be coming from diverse perspectives, an object could be deconstructed and reconstructed in many different ways. For example, a bird is a simple object, but it is unlikely to use one 2D model for all as a bird can stand still or fly; it could be viewed from the bottom, the side or from the top. Unlike 3D modelling, it is necessary to build various 2D models to anticipate different conceptions or situations. Carlier, Leonard, Hahmann, Morin, and Collins [56] conducted a study to collect data about how people decompose the structure of shapes. Their investigation covers 1200 shapes in 70 classes; it has at least 24 annotations per shape and a total of 41,953 annotations provided by 2861 participants. The result reflects that there are many ways to decompose shapes into diverse configurations according to different perceptions. Therefore, many compounds can be created to represent different perceptual models of the same object.

## 5. Metaphorical Relations, Relational Operations and Metaphorical Expressions

Unlike the other models, the MPM only provides placeholders for assembling objects according to conceptual relations which are eventually represented as spatial relations among the components of the model. Although many researchers have made tremendous efforts on the study of mereotopological relations, the focuses are mostly on the studies of physical conditions or spatial relations for engineering, mathematical or scientific purpose. To build a model to signify different metaphorical expressions, the metaphorical relation (MR) is proposed. For constructing the specific spatial relations to signify the MR, several Relational Operations (RO) are encoded in the MPM. The detailed discussion of the features and functionality of MR and RO will be discussed in the following sections.

### 5.1 Relational Operation (RO)

Relational operation (RO) is the operation which arranges the position of objects according to the specific spatial relations. It could arrange the objects according to the concepts of different MRs and then signifying different spatial relationships or metaphorical expressions.

Currently, fourteen ROs which are essential for the arrangement of the components are defined in the MPM. These relations include: alignTo, topOf, bottomOf, rightOf, leftOf, rotateAroundPoint, parallelTo, perpendicularTo, scaleBy, matchOneSide, matchExactSize, inside, meetAt and tipOf.

### 5.2 Metaphorical Relations and Metaphorical Expressions

A large proportion of conceptual metaphors belong to the orientational metaphor type are associated with spatial relations. While mathematicians and researchers have investigated the related theories for many years [57, 58], their efforts seldom come across the notice of visual communication designers. Nonetheless, the diagrammatic renditions of their mathematic theories provide great resources to signify the spatial relations between objects for making innumerable metaphorical expressions in different circumstances. These spatial relations, which could be considered as different kinds of image schemas, have been used to signify different meanings in the pictogram of Chinese oracle-bone inscriptions in ancient. Two distinctive examples in Figure 7 show the principle of image schemas by positioning the shorter stokes in two different relative positions and suggest the opposite meanings.

In the early stage of this study, the purpose of RO of the MPM was mainly for the synthesis of the visual composition; it is aimed at managing the spatial relations between different components in the MPM through geometric transformations. However, in the later stage, it has been found that these spatial relations could be constructed according to the principle of image schema to signify specific information and expression metaphorically. Therefore, other than organizing the composition of designs, the RO is also utilised to construct Metaphorical Relation (MR) to signify an additional layer of meanings.

**Figure 7: Ancient Chinese characters based on pictogram for "up" (left group) and "down" (right group) and their modern counterparts**

The development of the MR has also gone through different stages of evolution. At the initial stage, the principle of MR is more or less conformed to the conventional theories of two-dimensional design taught in design schools or practised by the professional designers. In this stage, the specifications of relational position among the objects are based on some rather straightforward and common patterns. For example, the concept of "Top of" mainly concerns about the relative position between two objects whereas one object would be placed at a position above the other one. This rather simple approach works in design practice as the human agent will fill in the rest of the missing gap intuitively without noticing that many subtle judgments have been made during the design process. Nonetheless, it will encounter different problems if the process is carried out by the computational method as many subtle conditional data and instructions required to create the generative design are missing. For example, all the conditions in Figure 9 can be considered as a "Top of" relations, however, each variation required additional information to differentiate the subtle variations in each case. In these cases, they all have a "Top of" relations in terms of the relative position between two objects, yet they have differences in the other spatial relations such as the distance between the objects or their "Length" relationship. Therefore, though all these compositions carry a "Top of" relations, each suggests different semantics according to the combined effect constituted by different types of spatial relations operated in each composition.

After a further study of the theories of image schema and incorporating the spatial primitives proposed by Mandler, a more elaborate schematic study of the interaction between different types of MR has been carried out. Through the deconstruction and reconstruction of our concept of the MR, it has been restructured and divided into six different dimensions namely, length, direction, distance, intersection, container and parallelism as listed in Table 7 below.

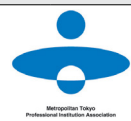
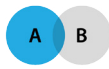
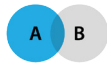
**Table 7: MR Dimensions**

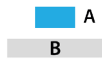
| Dimension Name | Description |
|---|---|
| Length | Comparison between comparable measurments |
| Direction | Relative positioning between two objects |
| Distance | How far apart objects are, relative to their size and context |
| Intersection | Count of intersecting points on object boundaries |
| Container | Description of the topological part-whole relationship between the two objects |
| Parallelism | Comparison of the orientation of various measurements (tension vectors, width-height ratio) |

The MR proposed above using six dimensions to identify different types of spatial relations. Users can use RO to specify either one or more dimensions to define a specific MR between objects. Therefore, both single or multiple spatial dimensions can be applied according to the requirements. In Table 8 different examples of brand mark design demonstrate the MR as applied in real-world situations. In this table, the classification may only indicate the typical dimensions of spatial relation showing in a design. In many cases, more than one dimension could be operated in a single MR. In the first example of "Longer than", some strips can be identified in the conditions of "Longer than" compared to the others. At once, some stripes are on the "Top of" the others while the others are on the "Right of" and "Bottom of" the other objects. So the possible meaning suggested by one single design can be quite rich as multiple MRs are operated in the design while different components interact with one another.

**Table 8: Spatial Relations between Two Objects and their Possible Metaphorical Expressions**

| *Relation* | *Description* | *Logo Examples* | *Possible Metaphorical Expressions* | | |
|---|---|---|---|---|---|
| **Length** | | | | | |
| Longer than | Measurement (e.g width) of A is longer than B | | authoritative<br>dominant<br>established | expending<br>full<br>generous | influential<br>plentiful<br>powerful |
| Equal to | Measurement of A is visually identical to B | | accompany<br>balance<br>equality | even<br>matching<br>partner | symmetric<br>competitor<br>fair |
| Shorter than | Measurement of A is shorter than B | | delicate<br>fine<br>gentle | humble<br>insignificant<br>minor | modest<br>progeny<br>subdominant |
| **Directional** | | | | | |
| Top of | A has a greater y-position (upwards) than B | | authority<br>climax<br>dominant | high rank<br>important<br>hierarchy | superior<br>good<br>influential |
| Bottom of | A has a smaller y-position (downwards) than B | | foundation<br>earthy<br>low rank | base<br>basic<br>support | endorse<br>subordinate<br>inferior |
| Left of | A has a smaller x-position (towards left) than B | | accompany<br>assist<br>backward | extend<br>lead<br>liberal | member<br>past<br>peer |
| Right of | A has a greater x-position (towards right) than B | | active<br>advance<br>assist | extend<br>forward<br>follow | future<br>companion<br>lateral |
| Front of | A has a greater z-index (forward) than B | | apparent<br>credible<br>dominant | exposed<br>forward<br>important | inviting<br>noticeable<br>open |
| Back of | A has a smaller z-index (backward) than B | | backing<br>back up<br>concealed | emerge<br>hidden<br>introverted | obscure<br>dependant<br>disguised |

| *Relation* | *Description* | | *Logo Examples* | | | *Possible Metaphorical Expressions* | | |
|---|---|---|---|---|---|---|---|---|
| **Distance** | | | | | | | | |
| Far | Size of A is larger than the size of B |  |  |  |  | distant<br>remote<br>unrelated | unfamiliar<br>strange<br>reserved | unknown<br>foreign<br>alienated |
| Near | Size of A is smaller than the size of B |  |  |  |  | closely related<br>intimate<br>friendly | familiar<br>intrusive<br>dependent | approachable<br>intimidating<br>recognizable |
| Superimpose | A and B are of same size |  |  |  |  | closeness<br>intimacy<br>familiar | sameness<br>wholeness<br>interchangeable | uniformity<br>equality<br>monotony |
| **Intersection** | | | | | | | | |
| Disjoint | Boundaries of A and B do not have 0 intersection points |  |  |  |  | separation<br>disconnection<br>dissociation | division<br>avoidance<br>correlate | comparison<br>standalone<br>independent |
| Meet | Boundaries of A and B have exactly 1 intersection point |  |  |  |  | contact<br>interactive<br>minimal | focus<br>fragile<br>brief | instant<br>approaching<br>association |
| Multi-joint | Boundaries of A and B have more than 1 intersection points |  |  |  |  | connection<br>joining<br>dividing | portion<br>meeting<br>similarity | agreement<br>bond<br>common |
| Shared Boundary | A and B shares the same partial boundary |  |  |  |  | sharing<br>association<br>agreement | peer<br>acquaintance<br>dependent | togetherness<br>union<br>connection |
| **Container** | | | | | | | | |
| Inside | A is within the interior of B |  |  |  |  | bounded<br>protected<br>secure | sheltered<br>surrounded<br>attention | cherished<br>child<br>comforting |
| Across | A consists of the interior and exterior of B concurrently |  |  |  |  | affiliated<br>component<br>associated | consensus<br>equality<br>friendly | linked<br>share<br>protection |
| Outside | A is at the exterior of B |  |  |  |  | accompany<br>balance<br>equality | foreign<br>partnering<br>symmetric | unrelated<br>disconnection<br>competitor |
| Enclosed | A is within the hollow region of B |  |  |  |  | confined<br>still<br>passive | imprisoned<br>protection<br>shelter | restricted<br>secure<br>certainty |
| Semibounded region | A is within the exterior of B's concave region |  |  |  |  | comfort<br>sheltered<br>bounded | guarding<br>safe<br>compassion | inviting<br>supportive<br>oppressive |
| Conceptual boundary | A is between the exterior and the concave region of B |  |  |  |  | breakthrough<br>progression<br>active | improvement<br>movement<br>advancement | possibility<br>aggressive<br>opportunity |

| *Relation* | *Description* | | *Logo Examples* | | | *Possible Metaphorical Expressions* | | |
|---|---|---|---|---|---|---|---|---|
| **Parallelism** | | | | | | | | |
| Parallel | The orientation of A and B are identical or have a 180 degrees difference |  |  |  |  | coordinated<br>peer<br>uniform | peaceful<br>polite<br>structured | obedient<br>equal<br>organised |
| Perpendicular | The orientation of A and B have a 90 degrees difference |  |  |  |  | established<br>respected<br>anarchic | different<br>resistance<br>opposition | obedience<br>structure<br>organised |
| Divergent | The direction of the force of A is parting from that of B's |  |  |  |  | spreading<br>loose<br>creative | different<br>irregular<br>organic | parting<br>dissonant<br>varying |
| Convergent | The direction of the force of A is heading towards that of B's |  |  |  |  | focused<br>precision<br>intense | connecting<br>approaching<br>imminent | acceleration<br>inevitable<br>agreement |

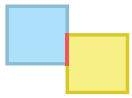
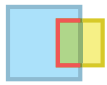
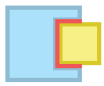
What makes spatial relations even more complicated is when objects of different synthetic and semantic properties interact with one and the other. For example, despite that the definition of the MR "Shared Boundary" is simply defined as: "Parts of the boundary of A are the same as parts of the boundary of B", the actual application of this relations could appear as different forms due to the differences between the form of object A and object B. Since a MR can be realised as so many possible compositions, it is necessary to identify the conditions that might constitute to these variations as well as the deviations in semantics. Currently, many scenarios have been tested and recorded in our knowledge base for analysis and further development. In general, these scenarios are identified either based on corpus analysis as mentioned in Section 3 or using a conventional design process. When using a conventional design process, a designer will use different design methods to seek solutions similar to a common design assignment. Some preliminary ideas based on either lateral thinking or rational process will be applied at the early stage. If a design can be matched with the MR presented in the exiting design, such scenarios will be kept in the knowledge base for further usage.

Then the preliminary ideas remained will go through another round of design process to seek for the other possibilities. As design is considered as a kind of ill-defined problem and new possibilities are always expected. So, this task is targeted for identifying a rich set of scenarios to facilitate the current development rather than making an exhaustive set. Once a collection of scenarios is available, it can be used as the reference for coding or annotating. In Table 9, a collection of scenarios that represents the MR "Shared Boundary" is shown. In each one, the criteria of different dimensions of MR are listed except "Parallelism" which has no effect to "Shared Boundary". With these additional criteria, many kinds of compositions with "Shared Boundary" can be generated to signify even more specific metaphorical expressions as listed in Table 8 since the conditions of the MR will become more confined to certain aspects. In the conceptual diagram of Table 9, only rectangles are used to illustrate the concepts of the different scenarios of "Shared Boundary". In real-world applications, different kinds of shapes will be used as shown in the brand mark samples. Therefore, another set of scenarios will be required if the boundary is shared by a line and a shape. Thus, to assure that a MR can work with different kinds of shapes or objects, more tables and specifications similar to Table 9 are required for handling the other scenarios.

In Table 8, a number of spatial relations are listed with brand mark examples to illustrate how specific arrangement of visual objects can potentially signify different expressions. Table 8 only indicates one-to-one relations; however, these relations could be applied to one-to-many or many-to-many situations as shown in Figure 8.


**Figure 8: (a) one-to-one, (b) one-to-many, (c) many-to-many relations**

**Table 9: Examples of Shared-Boundary Interacting with Different MR Dimensions**

| *No.* | *Conceptual diagram (yellow = main object)* | *Logo examples* | *MR Dimension* | | | | *Possible Metaphorical Expressions* | |
|---|---|---|---|---|---|---|---|---|
| | | | *Length* | *Direction* | *Distance* | *Container* | | |
| (a) |  |    | Equal to | * | Near / Far | Outside | precision allied dependent | organised constant reliable |
| (b) |  |   | * | * | Near / Far | Outside | comparable similarity resemblance | supportive commonality coexistence |
| (c) |  |    | * | * | Near / Far | Across | supportive hinting sub-dominant | assisting complementary back-up |
| (d |  |   | * | * | Near / Far | Across | attached dependant occupying | engaging distinction speciality |
| (e) |  |   | Equal To | Front of | Near / Far | Inside | sharing proportional component | extension composing integral |
| (f) |  |    | * | Front of | Near / Far | Inside | bounded travelling into opening | internal composing elemental |
| (g) |  |   | * | * | Near / Far | Enclosed | bounded constrained reserved | static focal point secure |
| (i) |  |   | * | * | Near / Far | Semi-bounded region | embrace valued important | protected secure immunity |
| (j) |  |   | * | * | Near / Far | Semi-bounded region | protected contained completion | within surrounded safe |
| (k) |  |   | * | * | Near / Far | Conceptual Boundary | interconnected dependent coincide | agreement blockade defensive |
| (l) |  |   | * | * | Near / Far | Conceptual Boundary | communal sharing mutual | correspond accompany mixing |

* This composition works for any type of this MR dimension

Through constructing the MR in a MPM with RO, different metaphorical expressions (ME) could be signified based on the principle of symmetrical object alignment (SOA). By choosing a source object with specific properties and combining with the relevant MR, the properties could be mapped to the target object and suggest the associated meaning. Thus, not only the literal meanings but also the metaphorical expressions could be delivered to the receivers from the design generated with the MPM.

As one of the main concerns of the MPM is for handling semantics, especially those related to expression and emotion, the principle of semantic differential could be utilised to control the parameters. By mapping the value of a semantic differential scale relevant to a specific parameter which controls the metaphorical relation, the form of the model could be modified and express such meaning respectively. For example, the weight of "authority" could be mapped to the relation "Top of"

whereas the distance between the top and bottom objects indicates the level of the "authority". The position of the top object could be placed at either a higher or lower position to signify different degrees of authority as shown in Figure 9. At the same token, the effect could be enhanced by concatenating the "Larger than" relation to the size of an object.

Other than passing the semantic values to the responding parameters according to the principles of symmetrical object alignment and semantic differential, machine learning could be applied to learn and drive the model if the proper interface is available. Nevertheless, the experimentation of these ideas are out of the scope of this paper and further development should be done in future.

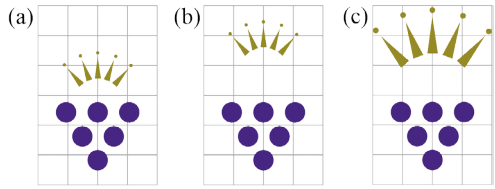



**Figure 9: (a) Original brand mark, (b) increase value of parameter "yOffset" in TopOf and (c) increase value of parameter "xScale" of ScaleBy**

### 5.3 Resolving problems of contradicting relations

As some of the MRs such as "Top of/ Bottom of", "Left of/Right of" shown in Table 7 are contrary pairs, some relations will signify divergent meanings depend on which object is under attention. For example, the object "A" may carry meanings of "authority", "high rank" or "good" while the object "B" may show the ideas of "support", "low rank" or "inferior". To a certain extent, the expressions of "authority" vs. "support", "high rank" vs. "low rank" are complementary pairs. On the other hand, the expression of "good" and "bad" could be contradictive when a unified brand personality is preferable. In general, this type of conflict could be avoided if the MPM is assembling according to the theory of visual rhetoric as only the appropriate object will be selected. Although a detailed explanation of visual rhetoric is out of the scope of the current discussion, a brief description could elucidate how the MPM would work with semantic issues. In general, if a unified concept is required, the choice of the nature of both object "A" and "B" should complement each other as the samples show in the top row of Table 8. Hence the expression of the complementary pair such as "authority/ support", "high rank/ low rank", and "good" will be dominant while the contradicted meaning "bad" will be submerged. After all, the metaphorical expressions of a design are affected by the nature of the objects as well as the relations between the objects found in the design.

If an object of a brand mark is a noticeable sign which carries distinctive meanings, the metaphorical expressions suggested by the metaphorical relations between objects could be overwhelmed by the semantics of such objects. For example, the construction of the brand mark in Figure 10, is based on the principle of the rhetorical figure "Antithesis". The object "A" and "B", which carry the "opposition of content" as defined by Durand [43, 44], are combined as a single compound. The composition of this design can be constructed by at least two different MR namely, "Left of / Right of " and "Cover / Cover by". In this case, metaphorical relations suggested by the "Left of / Right of " or "Cover / Cover by" will become minor. Here, the contradictive expressions suggested by the "happy face" object and "sad face" objects on both sides are showed in parallel and suggest the expression of "Anthesis" for representing the theatre group.


**Figure 10: Brand mark based on the principle of rhetorical figure "Antithesis"**

## 6. An Example of the Procedure of Making Brand Mark Design with MPM

A formal procedure of making brand mark design with MPM is described in this section so that users can acquire a better understanding of how to utilise the model in real-world applications.

- Before working on a design, the designer or user should get the design specifications with information such as the nature of the business, the target group, the brand personalities or specific requirement collected in advance. Here, an existing brand mark of Swiss Airline is chosen and recreated as an MPM for the purpose of demonstration and explanation.
- In general, visual communication designers will search for visual metaphors to represent the design concept. The choice of the metaphor could come from analytical processes such as a visual inventory of the other existing work created for a similar business or lateral thinking such as brainstorming. As this demonstration is based on an existing design, the first step to do is analysing and identifying the metaphor in the original design. Through the deconstruction of the original brand mark, two visual metaphors representing the concepts "Swiss" and "airline" are identified as Figure 11.

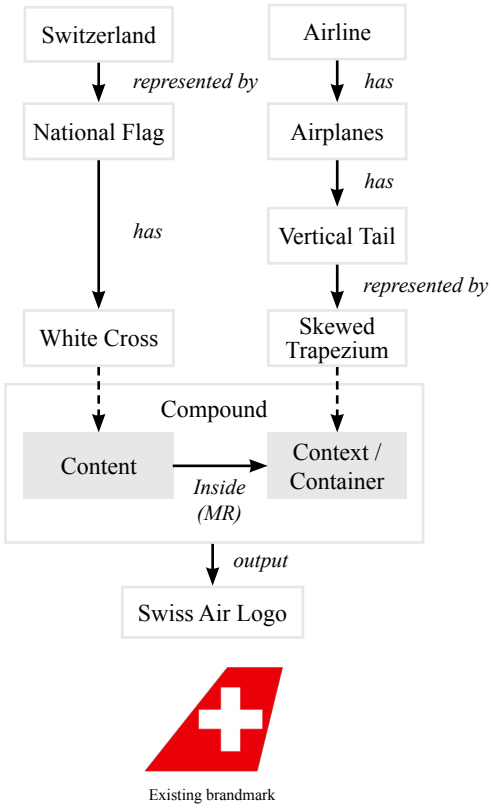



**Figure 11: Swiss Airline logo analysis**

- Depending on the design requirements, a brand mark design can be created by either an element, a compound or different combinations of both. As the Swiss Airline brand mark consists of two metaphorical concepts, creating a compound with two components will be a logical approach to initiate the design. To represent these two concepts, a compound consists of one placeholder to contain the concept "Swiss" and another one for the concept "airline" as shown in Figure 11 is created.
- Then these two placeholders are connected by one MR "inside" which will place the object "Swiss" enclosed within the boundary of the object "airline". According to the principle of image schema, this MR may suggest the metaphorical expressions such as category, material made, inside, locate within, affordances, and boundary.
- Then the metaphorical concepts are encoded as a compound as shown in Table 10. Following the original design, a trapezium and a cross are assigned to the placeholders of the compound first. By setting the relevant parameters to the MR, a replicate is created.
- By changing the parameters or the elements of the compound, design alternatives can be generated as shown in Table 11. With a different element on the back, the meaning of the "airline" can be transformed. Similarly, changing the front element can signify the other meaning as well.

**Table 10: Coded Simulation of Existing Brand Mark Design**

| **Swiss Air Brand Mark Example** |
|---|
| ***Simulated Result*** |
|  |
| ***Code Sample (Javascript)*** |

```
//create trapezium to signify airline
var tail = Trapezium.createComposed({
       length: 190, height: 170,
       angleLeft: 60,
angleRight: 90.5 })
tail.gt("skew", "x", -13, "CM", "g")
tail.style("fill", "red")

//create cross to signify Switzerland
var cross = CrossShape.createComposed({
       width:200, height:200,
       thicknessX: 60, thicknessY: 60 })
cross.style("fill", "white")

//establish MR between the tail and the
cross
cross.addRelation("alignto",tail,"CR",
       "CR",[15,0])
cross.addRelation("inside", tail, 0.85)

//plot resulting brand mark onto screen
var logo = Compo.createComposed({})
logo.addItem(tail, cross)
logo.plot()
```

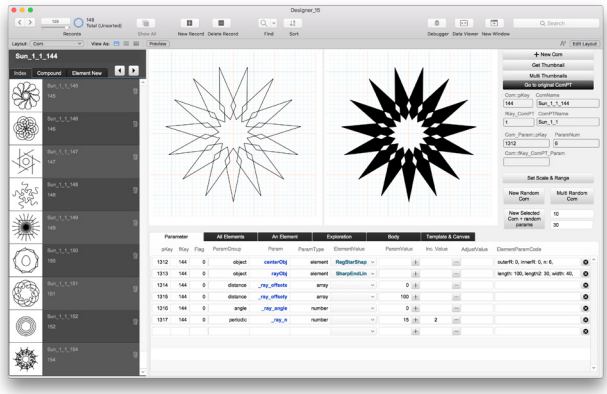
**Table 11: Variations of the Simulated Result**

| **Simulated Result** | **Description** |
|---|---|
| ***Change of Object*** | |
| Generated designs  Existing brandmark  | By changing the shape of the back element, different designs are created. These shapes are not the visual metaphors to represent the concept "airline"; however, they could represent the other brands from the Swiss. |

| Simulated Result | Description |
|---|---|
| ***Change of Object*** | |
|  <br>Existing brandmark  Adaptation  | By changing the shape in the front element, another group of design are created. As the visual metaphor of "Swiss" is replaced, this design could signify an airline associated with different places or institutions. |
| ***Change of Relation*** | |
| Generated designs  <br>Existing brandmark  | By changing the relations between the elements using Right Of, Part Of, Overlap and Top Of instead of Inside. The semantic meaning will change and signify different metaphorical expressions. |

By using the RO to create different MRs between the elements of the original composition, new metaphorical expressions can be suggested as well. By referring to the relations shown in Table 8, each of these new relations can signify a manifold of meanings diverged from the original meaning.

**Figure 12: Screenshot of Prototype with GUI Interface**



As the MPM and its related operations are still under development currently, the coding library has not released to public usage yet. However, a prototype built with FileMaker Pro, which is a relational database supporting HTML and Javascript for rapid prototyping, is available for designers with no programming experience to do design or experimentation. Through the GUI (Figure 12), users can assemble elements as compounds or using compounds to construct other compounds. By placing different objects into the placeholders and modifying the parameters of the objects or the MRs, users can explore a large number of designs in a short period.

## 7. Discussion

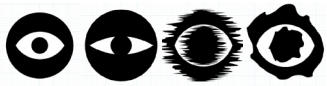
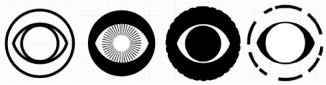
In order to create a universal model to facilitate visual communication design, building a model with the capacity for showing expression is just as important as representing information. The MPM proposed in this paper is an initial attempt to develop a new computational model for visual communication design based on the conceptual metaphor theory and visual rhetoric. The model is a representation of the semantic and metaphorical structure rather than any specific physical structure of a target object. Unlike some conventional architectural models which represent the physical structures of architectural forms, it only represents the most dominant conceptual structure perceived by the target groups. The structure of this model is not based on a definite ontological structure but a combination of conceptual and metaphorical structures. These structures are not only affected by our embodied experience but also our general knowledge prevailing in a specific group, society, or culture, not to mention the rules and regulations enforced by institutions or the other matters.

Based on the theory of symmetrical object alignment (SOA), we can map the metaphorical properties from a source object to the target object and signifying the intended metaphorical expressions. However, choosing the relevant components to construct a computational model requires specific domain knowledge. So, other than the knowledge of computing and coding, defining an MPM for making professional-grade brand mark design requires the understanding of visual communication design as well as the culture of the target audience.

When a visual form is displayed, the visual rhetorical treatments on graphic attributes are also crucial. For the same object, the choice of colour, line quality, texture or particular style could affect the expressions of the outcome. This kind of treatments is the same as the "metaphorical graphics", which is a type of metaphor for information visualization, described by Risch [28]. The visual rhetorical operations applied to graphic attributes always carry another layer of metaphorical properties which could affect the expressions signified in the design.

A detail discussion of the visual rhetorical effect of graphic attribute is out of the scope of this paper, however, the current MPM has already incorporated the concept that all graphics attributes can be used to signify metaphorical expressions as the examples shown in Table 12.

**Table 12: Variations of metaphorical expressions resulted from the changes of graphic attributes**

| Simulated Result | Description |
|---|---|
| *Change of Attribute* | |
|  | Changes in actual vector point location |
|  | Changes in styling methods (Vector points are not changed) |

It is obvious that the current MPM created with vector graphics can not represent photographic or raster images in the design. However, with the relevant adjustments, the MPM can incorporate raster image processing functions to generate both vector and raster graphics at once. So such limitation is mainly the technical issues related to the rendering of graphics and should not hinder the potentials of the MPM.

This paper mainly focuses on how the conceptual metaphor theory and image schemas are employed in establishing the structures of MPM. It explains the assembling of visual objects as conceptual metaphors for making metaphorical expressions through the manipulations of metaphorical relations. Though it has explained the concept of symmetric object alignment, there is no discussion on how to choose which object as the source object and how it is mapped to the target object. Also, there is only a brief description of how to arrange the objects to compose the final design based on the theory of visual rhetoric. In order to elucidate the design process such as how to select objects and control their parameters, it will require a more detail introduction and in-depth descriptions of visual rhetorical operation (VRO) which is out of the scope of this paper.

Currently, a few of VROs based on the seminal paper of Durand [43, 44] have been implemented to facilitate the construction of the MPM. By using the VRO together with the MPM, plenty of diversified designs could be generated and the results are promising. The idea of mapping different conventional rhetorical figures into an interactive matrix might help Durand to know how to apply verbal rhetorical figures to advertisings. However, in the later stage of the current research, after trying the implementation of some of the rhetorical operations suggested by Durand, the limitations of his studies become noticeable.

Since the structure of verbal and visual representation are quite different, the current study reveals that, for the development of visual language, the research of visual rhetoric should be based on its nature while verbal rhetoric should be taken for reference only. For example, the concept of inversion in the text is quite limited due to its linear arrangement. In graphics or painting, inversions [59] could be applied to more than one dimension which may include vertical and horizontal in spatial relations and the hue, lightness, and saturation in colour. Also, some symmetry patterns created with "repetition" can only be created in a two-dimensional plane but not the linear text. For example, the figure and ground phenomenon are gestalts unique to visual perception. As shown in many works of M.C. Escher, the metaphorical expressions revealed from the figure and ground gestalt in the symmetry pattern could not be recreated by the verbal rhetorical concept or in the linguistic form. Baruchello [60] has made a comprehensive study to identify the gestalt principles found in a large compilation of conventional rhetorical figures. The finding indicated that gestalt patterns could signify different rhetorical effects. However, the study also revealed that there is no schematic or distinctive correlation between the mapping of gestalt principles and rhetorical figures. Hence, it is obvious that the mapping between the gestalt and verbal rhetoric are not bilateral and it is quite reasonable to expect that some of the rhetorical effects that created with gestalt principles are unlikely to be found in the verbal rhetoric.

## 8. Conclusion and Future Development

The MPM proposed in this paper is only the first attempt towards a new type of model for visual communication design. Although the current study of the MPM is focused on brand mark design, obviously the same model could repurpose for signage design or icon design without the need of much modification of the core structure of MPM if the domain knowledge of these design types is provided. With the integration of the knowledge system of page layout and information graphics with the model, the application of the MPM can be further extended to the area of advertising or poster designs.

The usage of MPM is more versatile than expected; based on some experiments conducted previously, the same model can be used to simulate various types of pattern design or generative art as shown in Figure 13. This model is flexible and the users can modify the components and relations based on the theory of conceptual metaphor or visual rhetoric for an instant. Furthermore, though this model is initially developed for visual communication designers dealing with two-dimensional works, it could be adapted in different design disciplines immediately. For example, this model could be an ideal creative supporting tool (CST) for architects who need to design floor plans or facade layouts with symbolic meanings. As all the objects and relations in the MPM are encoded to signify the conceptual metaphor and visual rhetoric, this model

will allow the architects to create new designs in an environment which is difficult to achieve with conventional CAD systems.

Other than extending the application of MPM just mentioned, the study of visual rhetoric should never be ignored. When the MPM is applied to advertising, the utilisation and integration of visual rhetoric will demand different concerns as the visuals and objects used in advertising are more complicated and diverse. Furthermore, the structures and the components involved in a brand mark and advertising are quite dissimilar; hence, both require different kinds of visual rhetoric. So, other than meeting the demand that the investigation of visual metaphor should be based on the nature of the visual language and inherent to our visual perceptions as pointed out in the last section, the study of visual rhetoric should also be based on the nature of the types of visual communication. To fulfil these two demands, a new paradigm of the study of visual rhetoric should be established so that it can be grounded on its own and released from the shadow of verbal rhetoric and verbal language.

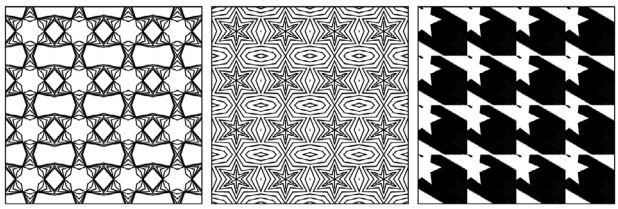


**Figure 13: Three different patterns based on the same element "Regular Star Shape"**

Last but not least, as Lakoff and Johnson [18] described a common conceptual metaphor found in human beings—ARGUMENT IS WAR. With such a concept, people use the structure of war to see an argument between different parties. People use the word and ideas such as fight, indefensible, weak point, target, demolished, shoot, strategy, opponent to deal with an argument. They suggested that if there is a culture which views argument as a dance, participants as performers, and the objective is to give a pleasing performance, then the result should become more constructive. In other words, the choice of metaphor could affect the thoughts and behaviour of people to a large extend beyond our awareness.

If metaphor is more fundamental than language, there should be dictionaries to archive the meanings of metaphors as well. As MPM is inherently a model created for representing visual metaphors, it would be an ideal model to contain visual metaphor and formalised as visual vocabularies. If a large number of visual vocabularies encoded as MPM are stored in a knowledge base, powerful resources would be available to facilitate different activities related to communication and thinking. As metaphor is part of our living as suggested by Lakoff and Johnson, the formation of metaphor is a continuous process and new meanings always emerge under different social and cultural activities. The currency and meaning of a metaphor can be changed from time to time. Therefore, it would be beneficial if there is a knowledge base for archiving the visual vocabulary in different space-time rather than one time for a single culture only.

Eventually, whether a user is from engineering, architecture, fashion or communication design background, or even a musician or poet, all could find some approaches to use the model to support one's works—by switching the mental image through the transformations of visual metaphors. Hence, through the building of MPM knowledge base with the metaphorical concepts of different cultures collected, we may be able to create a universal visual language to facilitate better communication and creativity for all in future.

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