

# Animatope: A Manga-Styled Animation Expression Toolkit

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## Abstract

*Manga, a Japanese comic style, is becoming widely accepted within comic readers worldwide. In Manga, mimetic symbols and onomatopoeia symbols are heavily used to express emotions and various movements in a comic frame. In this paper, we present a toolkit named "Animatope", to emulate Manga-style symbols in a non-photorealistic animation. Animatope transfers the Manga-style symbol grammar to 3D animation. We extend Manga symbols to Meta-symbols, or animated symbols, to enrich the emotional expressions and subtle behaviors. Meta-symbols are categorized into several classifications in Animatope Toolkit. Meta-symbols are controlled with basic parameters, shape of emitters, and motion handles.*

Categories and Subject Descriptors (according to ACM CCS): I.3.3 [Computer Graphics]: Non-photorealistic AnimationManga

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## 1. Introduction

### 1.1. Motivation

Non-photorealistic rendering and animation techniques are becoming widely used in films and graphic arts. Many of the rendering techniques are based on the visual styles of 2D pictorial arts such as traditional paintings, illustrations, and hand-drawn animations. For non-photorealistic animations, the grammar of hand-drawn animation such as the notion of exaggeration is adopted<sup>4, 10, 5</sup>.

In this paper, we present an approach for both non-photorealistic rendering and animation that is derived from Manga, a Japanese comic. As Manga comic started to attract many international readers, the grammatical and visual styles are widely accepted. In addition, the recent digital communication technologies, for instance, the instant messengers and chat systems, allow people to communicate with a symbolic text, such as the smiley-mark.

We divert the symbol adjunction system from MANGA/comics, to visual effects in animation. This adjunction system in 3D animation is designed and can be provided as a Toolkit for animators to easily adopt Manga-styled animation expressions.

### 1.2. Related Works

Most of the previous researches in non-photorealistic expression aim at the rendering process<sup>2, 6, 8, 16, 17</sup>. Researches in non-photographic animation include motion expression with exaggerations as well as facial animations<sup>3, 12, 9</sup>. Non-photorealistic rendering produces appealing visual results, but they lose visual details due to their simplification and abstraction algorithms. Therefore, it is often difficult to express subtle emotional expressions with these non-photographic techniques<sup>14</sup>. This holds true for non-photorealistic facial animation, and the techniques are limited in expression compared to the traditional hand-drawn animation. In our proposed technique, symbols derived from Manga comics are added to the non-photorealistic rendered images to represent situations and subtle emotions. Manga relies heavily on the use of added symbols to describe the emotional state and movement of objects. McCloud<sup>11</sup> indicates that Japanese Manga has distinguishing symbols in their works.

As an example of previous research that adopts comic expressions, Kurlander<sup>7</sup> developed a chat system using comic style representation, and demonstrated the power of comics for communication. Also, there are several case researches in animation tools for cartoon animations,<sup>13</sup> and video summarizing system using comic style sequential pictures.<sup>1, 15</sup>

Comic style uses symbols to express temporal and mo-

tion information in still images. Motion effects such as speed lines (called Z-ribbons) illustrates how the object move in the still image (Figure1).

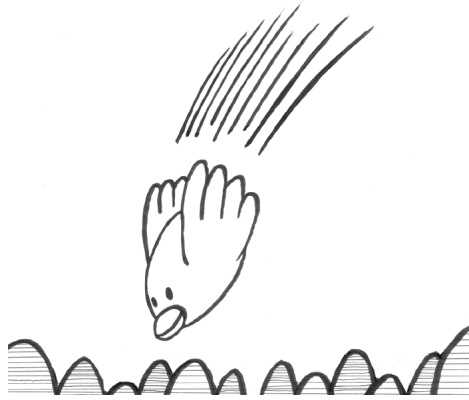


Figure 1: Z-ribbons

## 2. Comic Style Representations

Comic has a different style compared to other fine arts as for the point that it has time movement. A comic is constructed with block sequences of various sizes, each block displays keyframes having unequal intervals. The interval of time is separated in two levels: block level and still frame level. In other words, Comic style enables to animate objects in a still image. In this case, animation is focused on one object with additional symbols. Encoded Symbols are used to describe animation in still image.

The lines describing motion called "speed-line" or "Z-ribbons" are used to visualize object motion. This symbol represents object speed and vector of motion, similar to motion blur.

Other symbols are used to express the character's emotional state. These symbols are invisible in the real world, but the symbols are added in the comic to exaggerate the emotional state. For example, "sweat drops" metaphorically express the feeling of discomposure, as shown in Figure2.



Figure 2: Sweat drops

In our proposed toolkit, there are two types of symbols, a symbol and Meta-symbol. A symbol is an image, while a Meta-symbol consists of symbols and a description of motion so that symbols are dynamically expressed in time. Some symbols, such as "sweat drops", are derived from over exaggerating the physical movement. Other symbols, such as "cross pattern" depicting the feeling of "joy", illustrate internal emotion(Figure3. Meta-Symbols can better communicate with the audience by using animation and pose of character.

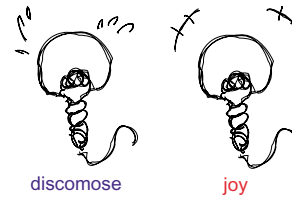


Figure 3: different pattern with same emitter

Additionally, comic style adopts texts as symbols for expressing mimetic words as well as onomatopoeia words. Appearance pattern is the same as the normal symbol, but the texts may appear as a word or independently. These are also invisible in the real world. Visualization of sound and mimetic word is an important factor to make the scene more effective(Figure4).

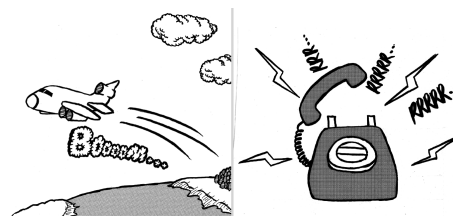


Figure 4: Visualization of sound and mimetic word

## 3. Algorithm for Meta-Symbols Generation

### 3.1. Classification of Meta-Symbols

Rules can be derived from examples of symbols used in Manga comics. In the fundamental drawing techniques of Manga comics, motion lines and symbols are defined as separate categories. In our approach, they can be controlled by similar algorithms(Figure5). In addition, onomatopoeia, or sound effects, can also be controlled by the same basic principle. We have selected popular symbols from Manga comics that are independent from the language and Japanese culture. The symbols are extended into Meta-symbols for dynamic expressions.

Each Meta-symbol can be classified into the following categories:

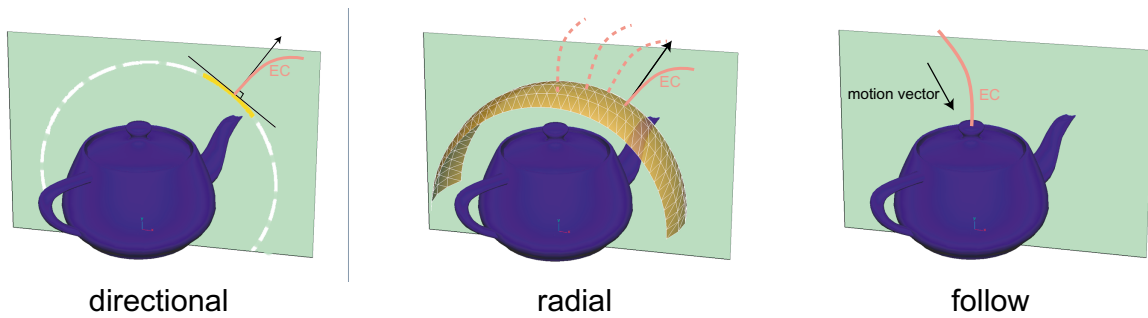


Figure 5: Symbol emitters. Symbols follow emit curve (EC).

### Directional

Meta-symbols are emitted with a directional curve. Directional symbols are mainly used to describe emotions of the character. By default, emitted symbols are emitted only once. When the "repetition" option is valid, symbols are emitted repetitively. Emission object is a curve.

### Radial

Meta-symbols are emitted along the normal vector of the surrounding hemisphere of the objects. This type is used for depicting emotions as well as invisible situations such as smell and vitality. Multiple symbols are emitted simultaneously with varying speed. Emission object is a U shape, similar to half pipe in skateboarding.

### Follow

Meta-symbols are emitted from object, and follow the object. These symbols help to describe an object's motion. Direction of the line follows the motion path. Emission object is the moving object.

### Random

Meta-symbols are emitted in spatial volume and move freely. These symbols are used to describe noisy and uneasy situations. In comics, mimetic words are often expressed with this style (Figure 6).

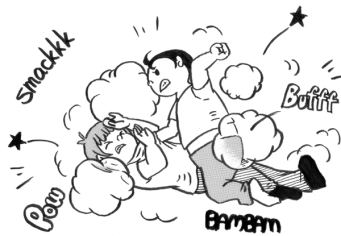


Figure 6: An example of random emitters.

### 3.2. Animation of Symbol

Adding animation to symbols makes the sequence visually more effective. Character motion and internal emotion become more impressive with meta-symbols. In addition, Meta-symbols add appealing effects to express internal emotions even if the character does not or cannot move. Animators can intuitively create the animation from the motion path defined in the meta-symbol. Some creativity may be required for using the mimetic and onomatopoeia-based meta-symbols because there is no reference in the real world.

### 4. Implementation

#### 4.1. Implementation Policy

The actual implementation method is designed to fit the following requirements:

- intuitive interface
- independent of spatial physical law
- symbol can be appended to any shape of object
- cascade control is possible

Our implementation does not rely on dynamic animation because Manga symbols are drawn as exaggeration that is not necessarily ruled by the laws of physics. The bounding box controller is implemented in order to position the symbols around the object within a given range. Additionally, the cascade control feature allows variation in motion and timing so that the generated animation becomes visually appealing. Motion of a symbol is controlled with basic parameters, emission range, and handle (motion path). When one appends Manga symbols to an object, the handle curve should be as simple as possible such as an arc or a harmonic oscillation, so that user can edit it as easy as drawing in onestroke.

#### 4.2. platforms

We selected Maya (Alias Wavefront) for implementation. Using commercial application like Maya, the toolkit can be accessible and easy to many users. Additionally, we used

Cel-style toon rendering to make it clearly understandable, but our representation basis does not depend on rendering method, so the user can select their favorite rendering type.

## 5. Results

Figure7-Figure11 are examples for each expression categories. Figure7 is an example of appending Directional Type, and it expresses that a teapot has noticed something. Figure8 shows an example of Emission Type. Bursting sweat represents dog's impatience. When the symbol object is replaced with another object, it becomes an expression of joy, as in Figure9. Figure10 is an example of Follow Type. This sample represents the difference from the usual motion blur. Figure11 is an example of Meta-symbols with text.

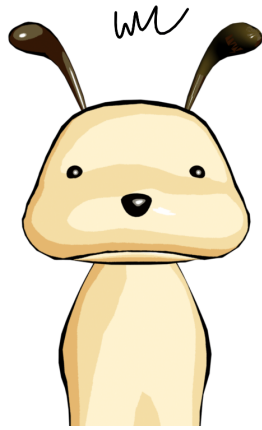


Figure 7: *directional meta-symbol*

## 6. Future Works

In this paper, we have presented an approach to incorporate Manga-style symbols. Although the proposed technique helps to realize various expressions with symbols, we believe that several improvements could extend the technique. Some suggested improvements are as follows:

**(1) Pursuit of view independent expressions.** We pursued Manga-style expressions, which are view-dependent. In our current technique, the camera is assumed to be in fixed position. It is important to account for camera movement, thus view-independent expression should be incorporated in the technique.



Figure 8: *radial meta-symbol*

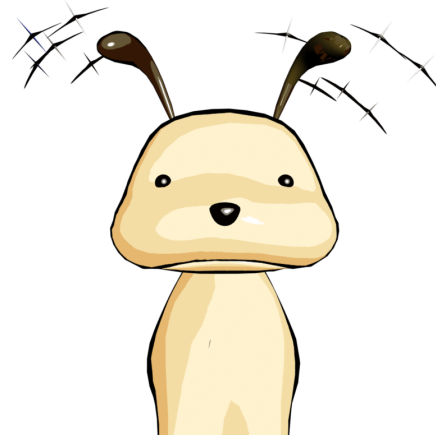


Figure 9: *another pattern of radial meta-symbol*

**(2) Addition of symbol effects to the camera** Similarly, it is necessary to consider subjective-motion that accounts for moving camera. This is especially important for depicting speed lines that expresses the movement of the camera point of view.

**(3) Expression of the symbols that intersects with objects** Some Manga symbols require symbols to be intersecting with objects. Our current implementation prohibits such

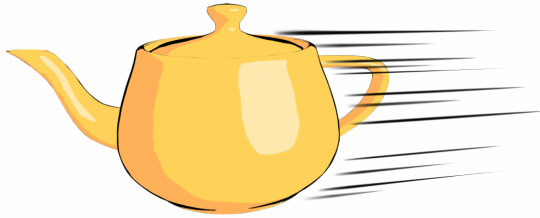


Figure 10: follow meta-symbol



Figure 11: meta-symbol with text

intersection, so it is important to extend the technique to account for the intersection.

In addition to the animation tool, we seek application areas such as live-action sequences for non-photorealistic visual effects, web and paper-based media expressions, as well as communication applications to enhance the non-verbal online communication.

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