

## STUDY ON THE USE OF MIMETIC WORDS IN MOTION DESIGN

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**Abstract:** We are developing a method to design a “creative and emotional motion” that resonates with deep feelings that are difficult to describe verbally. In previous studies, we developed a method of designing motions by combining base motions which expressed the designer’s feelings. This method may be applied to animated logos, etc. However, how base motions should be selected was not discussed. In this study, we attempt to support the selection of base motions by focusing on mimetic (reality-symbolic) Japanese words, which we believe can express deep feelings. Mimetic words express appearance, motion, and other phenomena, as opposed to onomatopoeic words, which imitate actual sound. We extracted mimetic words which indicate movement, and created a database of base motions from the motion of natural objects; mimetic words are related to base motions. We show the effectiveness of using mimetic words by combining base motions to generate a motion.

**Keywords:** *motion design, creative and emotional motion, blending, database, mimetic words*

### 1. Introduction

A significant ambition in the field of design is to create emotional objects (Norman, 2003). Meanwhile, because design in recent years has turned its focus toward forms and shapes, the output of the field has largely limited itself to these parameters. However, as so many media of expression have become available in today’s information society, design fields have widened their scope to include dynamic expressions such as sound, computer graphics, and moving logos. In fact, corporate logos with movement have appeared on the Internet. In this context, we intend to design an emotional motion that resonates with deep feelings. This motion should be applicable to animated logos to make them more attractive.

Music, another form of dynamic expression, can make a deep impression us. Music differs from natural sound in that it is a man-made creation and evokes feelings that go beyond ordinary human imagination. In this context, we assume in this work that a creative motion that goes beyond the ordinary human imagination can produce emotional impressions that resonate with deep feelings. Here, the term ‘emotional impression’ suggests an active impression evoked in the subject, something that touches deep feelings in the human mind, while the unadorned term ‘impression’ suggests a passive or static impression.

In previous studies, we developed a method for the design of a creative and emotional motion (Taura & Nagai, 2010; Yamada et al., 2010; Yamada et al., 2011). We found that motion tends to be imbued with more effective emotional impressions as it extends beyond the ordinary human imagination.

However, it is difficult to verbally describe motion that does not yet exist but nevertheless resonates with deep feelings. In this study, we focus on mimetic words in the Japanese language. While *onomatopoeic* (sound-symbolic) words such as *kachi-kochi* ‘tick-tock’ and *pon* ‘pop’ imitate actual sound, *mimetic* (reality-symbolic) words such as *shiku-shiku* ‘sobbing’ and *kune-kune* (which carries a meaning indicating that something is wriggling) express external appearance, movement, feelings, or other phenomena. We believe that mimetic words are capable of expressing deep feelings.

## 2. Design of creative and emotional motions

### 2.1. Our previous studies

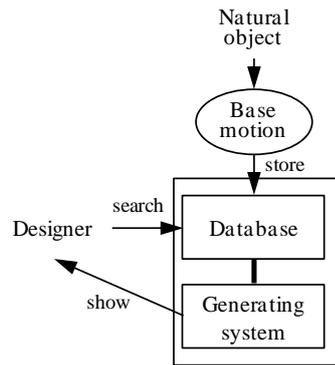
In our previous studies, we developed a method to design a creative and emotional motion that resonates with deep feelings. The method was constructed on the basis of the following strategies:

- **Mimicry of natural objects:**  
Humans have created many artefacts based on or suggested by natural objects whose movements are both unique and charming (Chakrabarti et al., 2005). For example, the analogy of biological systems has been used to develop solutions for engineering problems, in the field of biologically inspired design (Helms et al., 2009). Therefore, we decided to use natural objects as a source for designing a creative and emotional motion.
- **Emphasis on rhythmic features:**  
In order to generate a more creative motion that extends far beyond the human imagination, we attempted to emphasize the rhythmic features of motion. Rhythm in music involves, in part, the interrelationship between the accented (strong) and unaccented (weak) beats (Cooper & Meyer, 1960). Accents that are produced by stress (dynamics) imply the dynamic intensification of a beat—that is, an emphasis implied through the use of a louder sound. We attempted to emphasize the rhythmic features of a motion by increasing or decreasing their intensity.
- **Blending of motions:**  
According to studies on design creativity, concept blending is crucial to the creative generation of concepts (Nagai et al., 2009). Concept blending is based on combining two input concepts to yield a third concept. While a blended concept inherits part of its structures from the input concepts, it also includes emergent structures of its own. We applied the notion of concept blending to the design of a creative and emotional motion, and developed a method to blend motions generated by mimicking natural objects. (The blended motions are hereafter referred to as ‘base motions’.) This method is in line with compound analogy (e.g. Vattam et al., 2008), in which a new design concept is generated by composing the result of multiple cross-domain analogies has often been suggested.

First, we acquired our base motions by mimicking natural objects. Second, the rhythmic features of these motions were emphasized. Third, the rhythmic features were blended, and a new motion was generated. During the experiments in our previous studies cited above, the effectiveness of the proposed method was confirmed.

### 2.2. Objective

In our previous studies, we did not discuss how base motions should be employed. This is a very important issue for investigation. In the present study, we attempt to support the selection of base motions by focusing on mimetic words. First, we create a database of base motions. Next, we attempt to express the image of the base motion that the designer has in his or her mind by using mimetic words. The base motions and the mimetic words are interrelated and stored in the database of base motions.



**Figure 1.** Prospective system

In this study, we assume a system such as that shown in Figure 1. The designer retrieves base motions from the database by using ‘mimetic word’ as a keyword. Based on the selected base motions, a generating system produces a new motion by blending base motions and shows the new motion to the designer.

### 3. Mimetic words

#### 3.1. Characteristics of mimetic words

Today, the importance of onomatopoeia is discussed in many fields such as linguistics, psychology, cognitive science, sport science, and design (Takahashi et al., 2010; Mougenot & Watanabe, 2010). For example, Mougenot & Watanabe (2010) sought to explore the role of onomatopoeias as design stimuli. In the study’s experiment, participants were asked to sketch prospective products by using onomatopoeic words as ideation-stimuli. The results suggest that sound-symbolic words tend to support the design of products with a higher emotional value when used as inspirational stimuli.

The term ‘onomatopoeia’ found its way into English through Latin from Greek, in which it was coined from the roots *onoma* ‘name’ and *poiein* ‘to make’. Thus, *onomatopoeia* originally meant ‘making names (for things)’. Onomatopoeia refers to the imitation of sound, whereas mimesis refers to an outward appearance or inner feeling rather than a sound. All or almost all human languages have their own onomatopoeic and mimetic words; however, Japanese in particular has many and many varieties of onomatopoeic and mimetic words (Hasada, 2001). Onomatopoeic and mimetic words are one of the most fundamental, characteristic, and lively aspects of the Japanese language (Fukuda, 2003). Many of the first words that children learn are onomatopoeic or mimetic. However, this does not mean that onomatopoeic and mimetic words are felt to be childish; they are completely standard, and for native Japanese speakers, many concepts cannot be expressed clearly without the use of onomatopoeic or mimetic words.

As new Japanese onomatopoeic and mimetic words are coined, their new meanings are extended from their original meanings. In the present study, immutable mimetic words are used to express a motion. Therefore, we refer to several paper dictionaries (Gomi, 1989; Osaka, 1990; Fukuda, 2003; Kaida & Kuroiwa, 2007; Ono, 2007).

#### 3.2. Classification of mimetic words

Onomatopoeic and mimetic words express sound, motion, feeling, phenomena, etc. through the pronunciation of words. In order to investigate mimetic words that can be used for the design of motion, we classified onomatopoeic and mimetic words into four categories (Appearance, Feeling, Movement, and Sound) on the basis of their meanings. Examples of the classified words are shown in Table 1. The meanings of these words were reviewed as given in existing dictionaries of onomatopoeic and mimetic words (Gomi, 1989; Osaka, 1990; Fukuda, 2003; Kaida & Kuroiwa, 2007; Ono, 2007).

**Table 1.** Examples of classified onomatopoeic and mimetic words

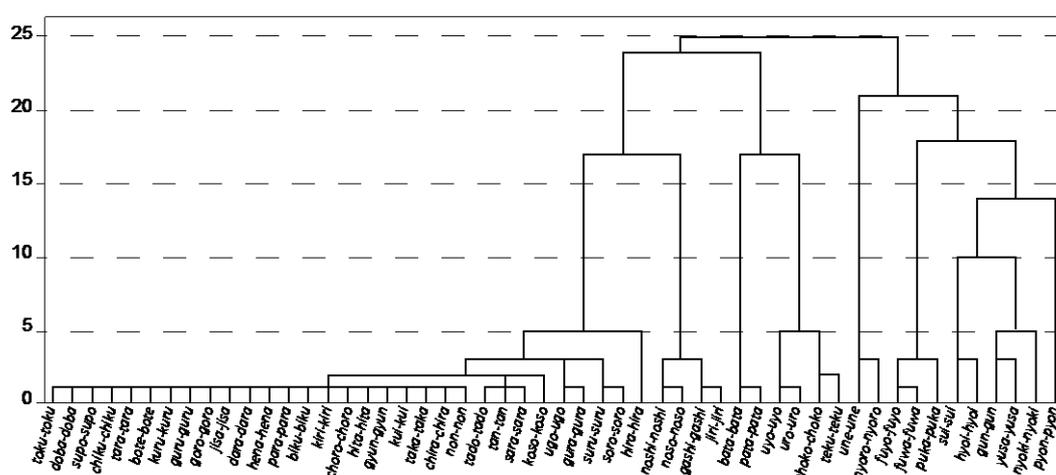
#	Word	Category	General meaning
1	<i>chon-chon</i>	Movement	Something light and small that moves rhythmically and continuously
2	<i>kan-kan</i>	Feeling	To be enraged or to be filled with fury
3	<i>kan-kan</i>	Sound	Sound of a hard object colliding with another
4	<i>kukkiri</i>	Appearance	Distinct, clearly visible
5	<i>mozo-mozo</i>	Movement	Something such as an insect is fidgeting or creeping about
6	<i>pon</i>	Sound	Pop!
7	<i>pon</i>	Movement	Something is popping or jumping
8	<i>shiku-shiku</i>	Feeling	Prolonged snivelling, whimpering, or sniffing
9	<i>surari</i>	Appearance	Slim, svelte, or slender
10	<i>wan-wan</i>	Sound	The sound of a dog barking: 'bow-wow'

The words that are categorised into 'movement', 'feeling', and 'appearance' are *mimetic words*. Onomatopoeic words are those categorised into 'sound'. In this study, mimetic words, in particular movement-type words, are focused on. However, there are too many of these to categorise in a database. Therefore, representative mimetic words should be identified.

First, 52 movement-type mimetic words were selected. Next, the subjects were shown a video of a natural object and a list of the mimetic words and asked to relate each movement (video) to the words. They were related in two ways (strong or weak) on the basis of the strength of their relationship.

The subjects were eight college students. A total of 12 videos were shown: the movements of a kangaroo, a monkey, a pigeon, a penguin, an alligator, a fish, a jellyfish, an ant, a butterfly, a sprout, and a flower. These were selected to each represent a different category of natural object.

The relationships were scored (0; non-relation, 1; weak, 2; strong) and subjected to a cluster analysis. Ward's method was employed as a hierarchical method. Figure 2 shows the cluster process (as a dendrogram). From its results, the nine groups in Table 2 were obtained. The highest-scored word in each group was identified as a representative mimetic word; the words thus identified were *hira-hira*, *noso-noso*, *bata-bata*, *choko-choko*, *une-une*, *fuwa-fuwa*, *sui-sui*, *yusa-yusa*, and *pyon-pyon* (see definitions below). These mimetic words were interrelated with base motions in a database.



**Figure 2.** Results of cluster analysis

**Table 2.** Mimetic words in each group

Group	Mimetic words
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1	<b><i>hira-hira</i></b> : fluttering, swirling <i>toku-toku, doba-doba, supo-supu, chiku-chiku, tara-tara, bote-bote, kuru-kuru, guru-guru, goro-goro, jisa-jisa, dara-dara, hena-hena, para-para, biku-biku, kiri-kiri, choro-choro, hita-hita, gyun-gyun, kui-kui, taka-taka, chira-chira, non-non, tado-tado, tan-tan, sara-sara, koso-koso, ugo-ugo, gura-gura, suru-suru, soro-soro</i>
2	<b><i>noso-noso</i></b> : moving slowly, clumsily <i>noshi-noshi, gashi-gashi, jiri-jiri</i>
3	<b><i>bata-bata</i></b> : moving busily in small motions; flapping <i>pata-pata</i>
4	<b><i>choko-choko</i></b> : walking or running with short steps, restless and constantly on the move <i>uyo-uyo, uro-uro, teku-teku</i>
5	<b><i>une-une</i></b> : winding, meandering <i>nyoro-nyoro</i>
6	<b><i>fuwa-fuwa</i></b> : something soft and light swells up or rises <i>fuyo-fuyo, puka-puka</i>
7	<b><i>sui-sui</i></b> : moving smoothly and easily though something <i>hyoi-hyoi</i>
8	<b><i>yusa-yusa</i></b> : swaying of something large and heavy <i>gun-gun, nyoki-nyoki</i>
9	<b><i>pyon-pyon</i></b> : hopping or skipping agilely

#### 4. Database of base motions

In order to gather motions that are plausible candidates for base motions, motion data was obtained from natural objects such as animals and plants by means of a MDO (Motion-Data Obtaining) system. This approach is based on the method adopted in the previous studies. The procedure is summarized below:

1. Load the first frame (snap shot) of a video of a natural object on the MDO system, and the target area is chosen by user.
2. Load the next frame.
3. Search the area in step2, which is similar to the target area in step 1.
4. Calculate the central point of the area in step 3 and record that point's data.

Steps 2–4 are repeated until the last frame of the video has been processed. The MDO system was constructed using the *Camshift algorithm* (Bradski, 1998) on an OpenCV (Open Source Computer Vision) Library. The Camshift algorithm tracks an object by searching areas similar to the target area using an HSV histogram. A HSV colour model is a colour space that plots colour as a spatial coordinate (tuples of numbers). As is well known, RGB or CYMK are other kinds of colour space. A HSV colour model corresponds to *Hue* (variety of colour), *Saturation* (the purity of a colour's hue), and *Value* (the value of brightness). The Camshift algorithm is often used for its ability to respond to a sudden change of motion.

By arranging the accumulated data of the point in a time sequence, candidates for base motions can be obtained. In the present study, 158 base motions are stored in the database. These base motions were obtained from each video and thus from several varieties of mammal, bird, aquatic animal, amphibian or reptile, insect, and plant.

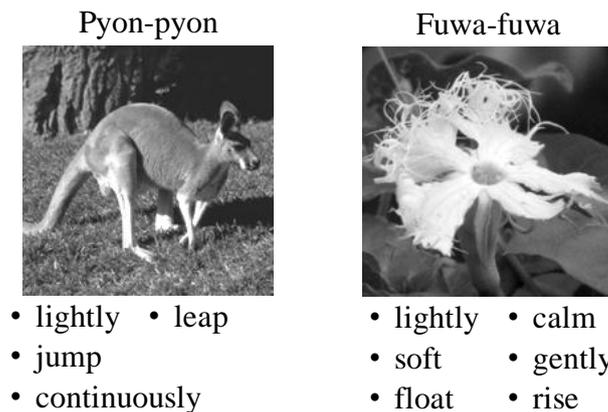
The obtained base motions were interrelated with nine representative mimetic words were identified in section 3.2 by an experimenter. The base motion and its interrelated mimetic word were then stored in the database.

For example, a base motion obtained from a clione (a kind of aquatic animal) was associated with *fuwa-fuwa* and *sui-sui*. Likewise, a base motion from a penguin (a kind of bird) was also associated with *sui-sui*. In other words, there is a many-to-many relationship between base motions and mimetic words.

## 5. Applied to the design of motion

As an example of our challenge in this project, the generation of a motion using mimetic words will be presented in this section. Following the method proposed in section 2, two base motions were blended to generate a new motion. First, two mimetic words—*pyon-pyon* and *fuwa-fuwa*—were selected. The meanings of these words are as follows:

- *Pyon-pyon* (Movement) The action of jumping or leaping lightly and continuously
- *Fuwa-fuwa* (Movement) The lighter and calmer motion of soft, light objects floating or rising gently in the air

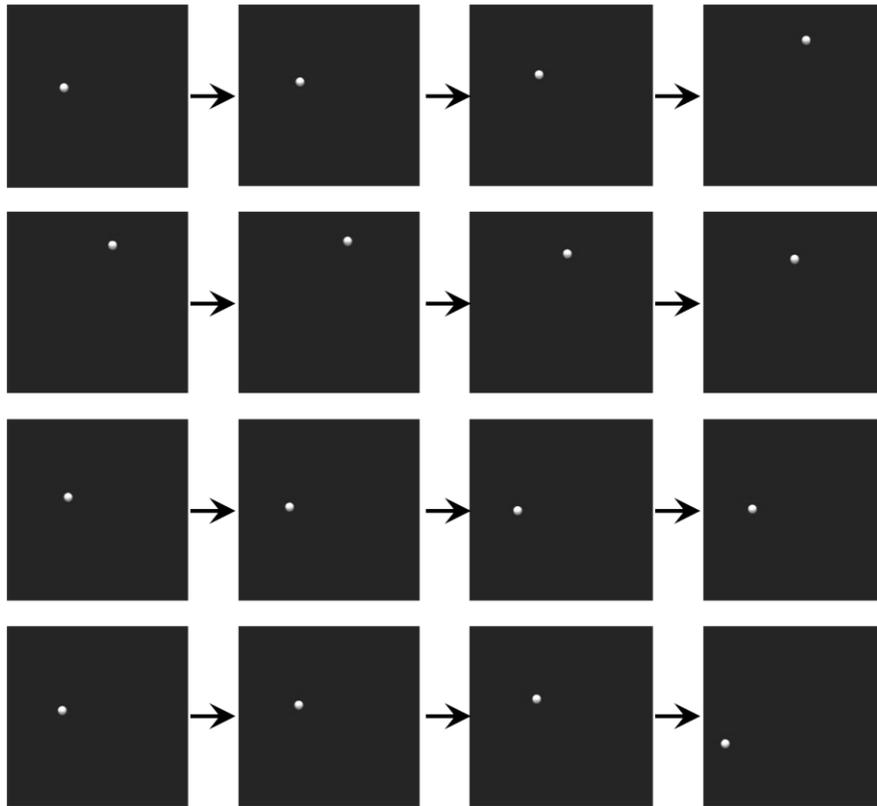


**Figure 3.** Base motions and properties of two mimetic words

The motion of a kangaroo jumping was retrieved as a *pyon-pyon* motion. The motion of a Chinese cucumber flower blooming was retrieved as a *fuwa-fuwa* motion. Figure 3 shows the images and properties of two motions. These properties were extracted from the general meanings of the mimetic words.

These two base motions were combined by the generated system proposed in our previous study. The image-generated motion is shown in Figure 4.

The video of this motion was shown to a subject—a native Japanese speaker familiar with the usage of mimetic words in Japanese. The subject was asked to express this newly generated motion using a new mimetic word; the speaker came up with *chon-pî*. When asked why, the subject said that *chon-pî* is constructed from *chon* and *pî* (with *pî* indicating smooth movement) and from *mozo-mozo*. From our analysis of mimetic words, we know that *chon* (as in *chon-chon*) refers to something light or small that moves continuously and rhythmically. *Mozo-mozo* is a mimetic word that refers to, for example, an insect continually creeping here and there in a small range. The properties of *chon-pî* overlap with the properties of *pyon-pyon* and *fuwa-fuwa*, such as, ‘light’ and ‘continuous’. The generated motion *chon-pî* thus inherits parts of each of these base motions.



**Figure 4.** Generated motion from the combination of *pyon-pyon* and *fuwa-fuwa*

## 6. Conclusion

We are developing a method of design for a creative and emotional motion. In the present study, we attempted to investigate how we should select base motions. In order to convey motions whose meanings are difficult to express in words, mimetic words were focused on; additionally, they were classified by the similarity of their meanings. Then, nine representative mimetic words were identified as high frequency in each group. An MDO system was constructed and 158 base motions were obtained from natural objects. A database of base motions that stores both the base motions and its interrelated mimetic words was then created.

For implementation of our method, we designed an emotional motion by combining two motions and showing them to a subject, who came up with a mimetic word to describe it. Through this case study, we confirmed the use of our method using mimetic words—showing that the generated motion inherited the properties from the base motions—and created a database to store those motions.

## 7. Future work

More case studies are needed to affirm the effectiveness of our method; additionally, a greater number of mimetic words and motions of natural objects should be added to the database. Additionally, we should confirm the validity of the interrelation between base motions and mimetic words.

Some objects that hitherto have been expressed statically can be expressed dynamically. However, the conventional tools for generating these dynamic behaviours have always been based upon visual or physical images created by the designer. An example could be a moving logo on the Internet. If a designer integrates a novel motion that does not yet exist into a static logo, to handle the motion with conventional tools will be difficult if the designer is not an expert in motion. Moreover, it is impossible to write down all the information needed to statically describe a dynamic movement and convey it to others. If our method and system are applied, animated corporate logos might become more widespread on the Internet.

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