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# Pow, Punch, Pika, and Chu: The Structure of Sound Effects in Genres of American Comics and Japanese Manga

**Abstract:** As multimodal works, comics are characterized as much by their use of language as by the style of their images. Sound effects in particular are exemplary of comics' language-use, and we explored this facet of comics by analyzing a corpus of books from genres in the United States (mainstream and independent) and Japan (shonen/boys' and shojo/girls'). We found variation between genres and between cultures across several properties of the content and presentation of sound effects. Foremost, significant differences arose between the lexical categories of sound effects (ex. onomatopoetic: *Pow!* vs. descriptive: *Punch!*) between genres within both culture's works. Additionally, genres in Japanese manga vary in the scripts used to write sound effects in Japanese (hiragana vs. katakana). We argue that, in English, a similar function is communicated through the presence or absence of textual font stylization. Altogether, these aspects of variation mark sound effects as important carriers of multimodal information, and provide distinctions by which genres and cultures of comics can be distinguished.

**Keywords:** visual language, multimodality, onomatopoeia, comics, manga, Japanese

## General introduction

Comics are inherently multimodal, and their use of written language can be just as emblematic of the art form as the style of its images. In particular, sound effects exemplify language-use in comics, second only perhaps to the speech balloon. From a linguistic perspective, sound effects represent the interplay between the various modalities of language present in comics, and therefore function as a sort of "crossroads" at which the reader is able to stand and experience meaning in multiple ways (Petersen 2009). While several studies have looked at the ways that sound effects and onomatopoeia are translated between comics of different cultures (e. g., Zanettin 2008, Jüngst 2004), few studies have examined in a systematic manner the presentation or content of sound effects in comics directly, either within or between cultures. Such an effort requires a corpus-based approach that gathers and reports on data across a variety of works. We have therefore examined, using such a process, the structural properties of sound effects within two genres of American comics and two genres of Japanese manga, as well as comparing these features across cultures.

In comics, sound effects may be a written form of the verbal modality, but they are often styled visually in ways that normal English text is not. While the text of a sound effect does not become a part of the "visual language" of the images (Cohn 2013b), they do take on image-like qualities that allow them to more seamlessly integrate with images. For example, though speech balloons just encapsulate regular text, sound effects are often integrated into the composition of the image without any "carrier" holding the text, and their depiction may have semantic and imagistic qualities, such as letters of an angry utterance appearing aflame to emphasize a metaphor for anger (Forster et al. 2012). This becomes especially relevant in works like manga, which do not use the Latinate alphabet, and where selection of script may also influence these visual and semantic properties. Manga from Japan freely make use of the multiple scripts in written Japanese (discussed below), and authors of Japanese fiction switch between these scripts to achieve varied stylistic effects (Smith and Schmidt 1996; Robertson 2015; Iwahara et al. 2003). Thus, while sound effects are not part

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of the conventions of the visual language of comics' images, they are nevertheless integrated into the larger conventions that manifest through the multimodal system as a whole (Cohn 2013a, 2016).

Sound effects can play multiple functions in a visual narrative. While they can simply illustrate the "sounds" that elements make, they further allow for semantic information that may be hidden from the visual representation. For example, they can be used to illustrate invisible qualities of the images, such as an object's manner of motion or a character's emotional affect (Petersen 2009). In carrying out these functions, sound effects often communicate auditory information that one normally does not experience in a language's conventional lexicon; they display significant productivity with novel words and expressions often created to suit the particular sounds being conveyed (Kadooka 2005).

As "carriers" of text in comics, sound effects use the same structural features as "regular" text in captions, speech balloons, or thought bubbles (Cohn 2013a, 2013b). All of these representations have three primary structural features, as depicted in Figure 1: the *carrier* (the thing holding the text), the *root* producing the sound, and the *tail* connecting the two. All three of these elements may or may not be depicted visually. For example, speech balloons may or may not have the actual balloon (the carrier), the tail, or even the root (a character may be "off-panel" with a tail pointing to the edge of the panel, implying their presence). The stereotypical sound effect often uses no explicit carrier (the text "floats" in a panel) nor a tail, though these elements "exist" implicitly to bind the sound effect to their root – the "producer" of the sound.
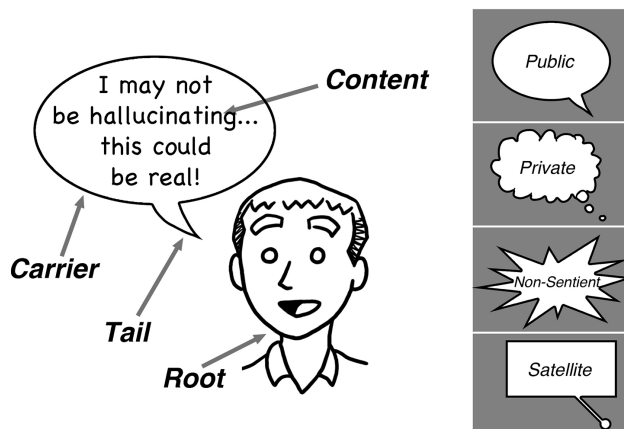


**Figure 1:** The tripartite emergent structure of carriers, linked to their roots by tails, along with the four types of carriers depicted in their prototypical surface features.

Additional semantic features relate to who has access to the content of a carrier: the "awareness" of its content by the root or other adjacent entities, the "audience," in the scene. It is through these distinctions that different types of carriers arise. *Private* carriers are those whose content is known only to the root producing it (prototypically thought bubbles). *Public* carriers contain content privy to both the root and any other adjacent characters in the scene (prototypically speech balloons). *Satellite* carriers are those whose information is unknown to both root and audience; these are understood to be only "visible" to the reader themselves (prototypically captions or labeling boxes). Finally, *non-sentient* carriers contain content of which the root is unaware but other characters are; that is, the root lacks the awareness required to understand that it is producing the content of the given carrier (prototypically sound effects).

These underlying features thus allow for a separation between the underlying semantics and the surface representations of a carrier. For example, a surface representation of a rounded "balloon" with a pointed tail may be a public carrier (when prototypical as a "speech balloon"), as a private carrier (as a "thought bubble", such as when holding a question mark coming from an animal like Charlie Brown's Snoopy), or a non-sentient carrier (as a "sound effect," such as when a balloon holds a sound effect with a tail pointing to an inanimate object). In these cases, the surface form may be similar, but the underlying semantics change. In contrast, both a thought bubble and caption may be private carriers, showing content

accessible only to a root. Here the surface form of the carriers differs despite the fact that both convey the same semantic idea. Thus, the surface representations of carriers is not enough to characterize their meaning and function in a visual narrative.

Nevertheless, surface representations of carriers may provide additional semantic meaning beyond these underlying features related to "awareness" of roots and adjacent entities. Whether a carrier has a wavy, jagged, square, or other shaped border may determine additional specificity about its meaning (Cohn 2013b; Forceville 2013; Forceville et al. 2010). For example, jagged edges mean loudness, whether used for "yelling" in speech balloons (public carriers) or a loud sound of a sound effect (non-sentient) – which vary in their underlying semantic features. Interestingly, the semantic traits of certain features like these can be recognized by pre-literate children (Yannicopoulou 2004), prior to their differentiation between carriers depicting thoughts or speech (Takashima 2002; Wellman et al. 1996; Yannicopoulou 2004).

Not only do sound effects differ in their structural features and broad semantic presentations, but they also may differ in the *lexical category* of the words used to convey content. Stereotypical sound effects are *onomatopoeia* which are words chosen to iconically mimic hearable sounds. Well-known examples include *boom, splash*, and *pow*. Academic efforts studying and cataloging these terms in comics began in the 1940s (Hill 1943a, 1943b) and continue to the present (Bredin 1996), with particular attention paid to the nuances – and often obstacles – found in translation of onomatopoeia from one language to another (e. g., Zanettin 2008; Jüngst 2004). In addition, research from developmental psychology on onomatopoeia in Japanese manga has suggested that their understanding increases with age (Nakazawa 2016): children at kindergarten ages displaying almost no understanding of their meaning (5 % accuracy), rising to poor understanding from 1st through 6th grade (~30 %), and moderate proficiency by 8th grade (54 %).

Though onomatopoeia are prototypical "sound effects" in comics, sound effects may describe the events, actions, or emotions that take place without attempting to be iconic of sounds (Catricalà and Guidi 2015). "Descriptive" sound effects may "describe" the action or sound being portrayed as opposed to merely mimicking the sound it produces. For example, as in Figure 2, an image of one person punching another may be accompanied by an onomatopoetic (*Pow!*) or a descriptive sound effect (*Punch!*). Such descriptive sound effects have only recently been discussed in scholarship of comics (Guynes 2014) though this "reuse" of the word describing an action has been called "cheating" by some comic authors (Walker 1980). Furthermore, other languages may use "sound effects" to describe actions or states that do not correspond to any hearable sound. For example, the Japanese language has a class of "sound effect" known as *gitaigo* that includes descriptors for the "sound" of silence and the "sound" of sparkling (Akita 2009; Hamano 1998), as will be discussed further below.
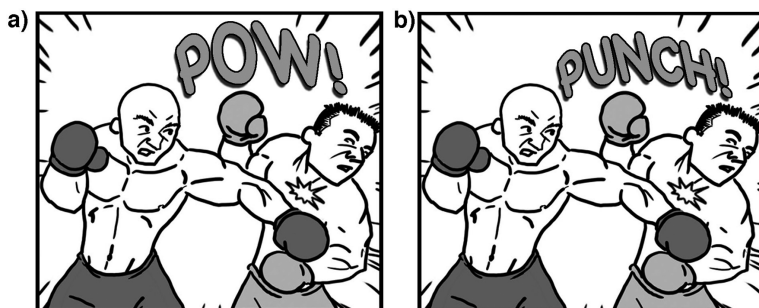


**Figure 2:** Onomatopoetic and descriptive sound effects.

Given that sound effects are emblematic of comics themselves, we hypothesized that they can provide a way of characterizing different types of books, such as different genres of comics within and between cultures. In particular, we hypothesized that certain characteristics of sound effects would differ between mainstream and independent genres in American comics (Study 1) and also between shonen and shojo

genres in Japanese manga (Study 2). Such differences would aid in distinguishing these genres as aimed at different audiences and following subtly different conventions. In addition, given the differences in the scripts used in English and Japanese writing systems (discussed below) we believed that differences would also arise between the sound effects used in American and Japanese works, regardless of genre. We will expand on our specific predictions below.

## Study 1: American comics

We first compared mainstream and independent comics from the United States. Mainstream comics were identified as those associated with the superhero genre, which follows certain well-defined patterns (Duncan and Smith 2009; Klock 2002). While these works have existed since the 1930s, several core characteristics have persisted despite peripheral changes (Mazur and Danner 2014). Their production often follows an "industry line" model, distributed across many stages and people – there are separate colorists, writers, inkers, drawers, etc. The publishers that print these comics specialize primarily if not exclusively in their production; the most well-known of these are DC and Marvel Comics.

The content of the mainstream comics is similarly conventionalized. Whether explicitly about "super-heroes" or not, stories center primarily around adventure, fantasy, science fiction, and other "power fantasy" themes in which a hero fights for righteousness against villainy, ventures into an otherworldly realm, accomplishes some superhuman feat, and/or offers or bestows some boon to mortal mankind, among others (Duncan and Smith 2009; Klock 2002). These themes are reinforced by the highly standardized visual style of characters, both male and female, having athletic, toned bodies, with movement similarly "athletic." While there is some variation, these visual tropes remain consistent across a wide variety of artists (Cohn 2013b).

For our purposes, text in both dialogue and sound effects is rendered in a style meant to evoke handlettering. Historically, lettering was done by hand, but modern production uses digital fonts designed to echo a handwritten feel. This handwritten feel is present in both "regular" text and sound effects, but distinct fonts are generally used for each. Overall, this craft of "lettering" has grown to include several conventionalized "rules" (Piekos 2009).

In contrast, independent comics emerged as an alternative to the aforementioned mainstream super-hero genre that, by and large, dominates the comic industry in the United States. This tradition has changed over time, often with loose continuity, if any, between movements, ranging from the underground comix movement in the 1960s and 1970s to the contemporary push of independent "graphic novels" in recent years (Mazur and Danner 2014). The publishers involved in the printing of independent works differ from those involved in superhero work; these labels are often much smaller than those involved in the production of superhero material, and much fewer people, in general, contribute to the production of independent comics. Often they are characterized by single authorship for the story, artwork, lettering, etc.

The visual style of independent comics, while much more variable than that of mainstream comics, has involved depictions either more "realistic" (approaching photorealism) or more "cartoony" (more abstraction) than superhero comics. Individual artists have much more influence on the appearance of an independent comic than they would in the superhero genre; there is little if any visual uniformity across artists (Witek 2012). While mainstream and independent comics appear to differ substantially in their visual styles, other corpus analysis has found that their underlying panel structuring is more alike than different, especially compared to Japanese manga (Cohn et al. 2012). For the purposes of this study, we therefore group together these significantly different works under the umbrella of "independent" for the reason that they stand apart from the mainstream genre. The independent genre, especially as we have defined it, serves an excellent counterpoint to the highly conventionalized, rigid style of mainstream superhero comics; each is characterized by a different sort of expressive identity.

Given these substantive differences in the production and content of mainstream comics and independent comics, we hypothesized that each genre would also treat sound effects differently.

## Methods

### Materials

We selected 20 comics for this study, 10 "superhero" or "mainstream" comics and 10 "independent" comics. The mainstream comics were published by either DC or Marvel Comics between 1976 and 2014; independent comics had a wider variety of publishers, spanning 1968 to 2009. A full listing of materials analyzed is provided in the Appendix.

### Areas of analysis

We coded instances of sound effects in our selected works for characteristics that fall into two primary categories: *Content*, related to the semantic qualities of the specific sound effects, and *Presentation*, related to the surface appearance of carriers.

### Content

As described above, Cohn (2013b) argues that text-image relations in comics use a three part relationship between the carrier (the holder of text), the root (an element connected to the text) and a tail (the link between carrier and root). We coded carriers for their four different semantic types (as described above), depending on who is "aware" of their contents: *private, public, non-sentient*, and *satellite*. A more detailed discussion of carrier awareness is available in Cohn (2013a, 2013b). We categorized carriers into these basic semantic categories, as well as noted surface features by which they differ (discussed below).

Because the semantics of a carrier can be modulated by the "awareness" of its root, we also coded for root animacy. Animate objects are defined as anything that has the capability to understand or be aware of the fact that it is making the noise that is being expressed in the carrier (e. g., humans and animals). Objects lacking conscious awareness of the sound they were making were coded as inanimate (e. g., tables as they scrape against the floor, chairs as they fall over, or rain as it patters against the sidewalk).

Finally, we classified these sound effects into one of two lexical categories: *onomatopoeic* effects and *descriptive* effects. The former type refers to instances used specifically to iconically approximate an audible sound; *crack, boom, squawk, krrrash*, etc. In contrast, the descriptive type of sound effect refers to noniconic, descriptive representations of actions or states. For example, a person hitting someone else could have a "sound effect" that says *Pow!* (onomatopoeia) or one that says *Punch!* (descriptive), as in Figure 2.

### Presentation

Though carriers differ in underlying semantics, they may look similar to each other on the surface. As discussed above, jagged edged carriers are used to show "loudness" for both public carriers ("speech balloons") and non-sentient carriers ("sound effects") despite having different underlying semantics (Cohn 2013a, 2013b). Thus, we also coded for these variations in surface representations (Forceville et al. 2010), including: 1) *Smooth*–the typical smooth-edged, round speech bubble; 2) *rectangular*–the carrier was rectangular in shape; 3) *bubble*–the stereotypical cloud-shaped bubble often used for thoughts and internal dialogue; 4) *spikey or jagged*–the shape of a multi-pointed star or explosion; and 5) *wavy*–a roughly sinusoidal, undulating curvature. We also coded for *compositionally enclosed* carriers–when no enclosing carrier was used and the sound effects was written directly on the panel – and for *colored backgrounds*– when the background of the carrier was any color other than white.

We also coded for whether or not the carrier in question possessed a tail: a line or other visual indicator connecting it to its root. However, we did not specifically investigate variations in the type of surface tails that were used.

In addition, carriers often do not appear isolated on a page, and thus we also examined how they related to each other. For example, carriers could be *linked*, when they were composed of two or more carriers meshed together into one larger one. We also examined whether carriers overlapped across several panels or extended beyond panel borders (Groensteen 2007).

Sound effects also use interesting features of individual words across two main categories: *typographic stylization* and *character repetition*. Stylized text used a different font from that of the regular dialogue text of the comic, while non-stylized maintained the same font style. Character repetition coded whether the sound effects used repeating characters or character sequences: for example, *crack* does not exhibit repetition, but both *craaaaaack* and *crackckckckck* would.

### Data analysis

We coded for these traits of sound effects throughout our sample comics. Our analyses generated means based on the number of particular properties of "sound effects" out of all in a given book. Means across books were then compared between genres using Independent Samples t-tests to determine whether or not the observed proportions differed with statistical significance across genres.

## Results and discussion

Results for our coded categories are provided in Figure 3, with statistical analyses in Table 1. We found no difference between carrier types across genres, nor with the animacy of the root. Our primary finding concerns the lexical category of sound effects, as we observed a large difference between the usage of onomatopoetic and descriptive sound effects between mainstream and independent comics. All of the sound effects in mainstream comics were onomatopoeic, with *zero* usage of descriptive sound effects. Independent comics also used onomatopoeia to high proportions, but descriptive sound effects did appear as well.

These findings suggest that onomatopoetic sound effects are far more prevalent in American comics in general than descriptive sound effects. In particular, our data suggests that descriptive sound effects are not used at all in American superhero comics; we find this to be fairly striking and surprising. Indeed, Guynes (2014) offers examples of descriptive sound effects taken from superhero comics, which shows that they do exist, at least somewhat. Thus, the total absence of them in our data must be viewed as a reflection of the content of our sampled corpus. Nevertheless, it is clear that the use of descriptive sound effects is extremely minimal in superhero comics, while merely rather scarce in independent comics.

We additionally found a few points of difference between genres with regard to presentation. No surface features differed between genres except that mainstream books used more compositionally enclosed sound effects than independent comics, and had a slightly higher rate of carriers overlapping with panels. In addition, mainstream books used more stylized text (i. e., text that differed in font from that in other carriers). This last finding is consistent with that of Forceville et al. (2010), who found the greatest amount of stylized text in an American mainstream superhero comic, *Avengers*, when compared with various European comics. No other significant differences were observed between genres. We noted, however, that, contrary to claims that repetition in sound effects is used to reinforce certain visual morphemes such as suppletion (Guynes 2014), we found no significant difference in the proportions of this element between genres.
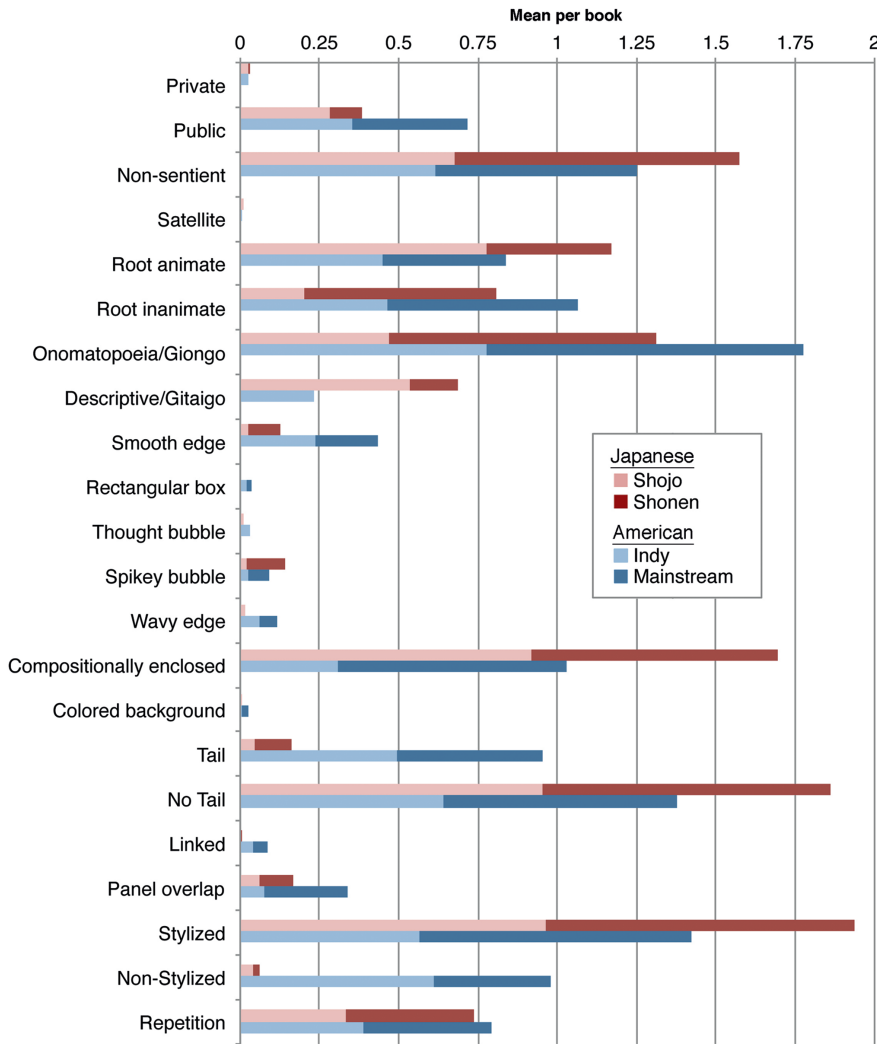
**Mean per book**



**Figure 3:** Variations between genres of comics from the United States (mainstream and independent) and Japan (shojo and shonen) for features related to sound effects.

# Study 2: Japanese manga

Though traditions of sequential image narrative have existed in Japan since the twelfth century (Schodt 1983), manga primarily descended from comics imported from the West into Japan in the twentieth century (Gravett 2004). Despite this initial influence, contemporary Japanese manga have developed their own unique characteristics and conventions over the past century (Cohn 2013b). Given the unique characteristics of the Japanese language and its usage in manga, we sought to contrast our initial analysis of American comics with an investigation of the use of sound effects in Japanese manga.

There are several aspects of written and spoken Japanese that make sound effects in manga particularly interesting. First, unlike English, which uses a single alphabet, written Japanese uses four different scripts. The first two, hiragana and katakana, are syllabaries that directly represent the sounds of the language. The third, kanji, is a Japanese adaptation of logographic Chinese characters. The last, romaji, refers to the transliteration of Japanese using the Latinate alphabet. Each is used for a different purpose; hiragana and kanji are together used to write words of Japanese origin, while katakana is used

**Table 1:** T-values for statistical analyses between genres and between countries.

| | US Indie vs. Mainstream | Japan Shojo vs. Shonen | U.S. Comics vs. Japanese Manga |
|---|---|---|---|
| | t(18) | t(18) | t(38) |
| Private | 1.121 | 1.314 | 0.07 |
| Public | −0.155 | 3.81** | −3.36** |
| Non-sentient | −0.219 | −4.118** | 2.959** |
| Satellite | 1 | 1 | 0.752 |
| Root animate | 0.718 | 4.764** | 2.343* |
| Root inanimate | −1.714 | −5.105** | −1.808^ |
| Onomatopoeia/ Giongo | −3.138** | −8.196** | −3.556** |
| Descriptive/Gitaigo | 3.206** | 8.196** | 3.47** |
| Smooth edge | 0.628 | −1.5 | −3.491** |
| Rectangular Box | 0.361 | – | −1.73^ |
| Thought bubble | 1.32 | 1.601 | −0.931 |
| Spikey edge | −1.037 | −2.136* | 0.833 |
| Wavy edge | 0.196 | 1.29 | −2.256* |
| Compositionally Enclosed | −4.574** | 2.115* | 4.565** |
| Colored background | −0.777 | 1 | −1.069 |
| Tail | 0.233 | −1.409 | −5.032** |
| Linked | −0.164 | −1 | −3.261** |
| Panel overlap | −1.886^ | −0.995 | −1.481 |
| Stylized | −2.773* | −0.727 | 4.153** |
| Repetition | −0.145 | −0.799 | −0.444 |

Notes: **$p < 0.01$, *$p < 0.05$, ^$p < 0.1$.

to render loanwords of foreign origin. Romaji is primarily used by native speakers only for computer input or places necessary to communicate with those illiterate in the other Japanese scripts, such as train stations and airports (Coulmas 1989; Smith (Shibamoto) 1996).

In addition, the lexical categories "onomatopoetic" and "descriptive" do not as cleanly characterize the variation of sound effects in Japanese manga as they do those found in American comics. Japanese, like English, does use onomatopoeia to refer to hearable sounds: analogues exist for words like *boom* and *splash* and *meow*. This class of iconic representations of exclusively "hearable" words is referred to as *giongo* (擬音語), which literally means "sound-mimicking words." However, another class contains words that do not refer to any particularly audible sound but instead the state or condition of an object. This class is referred to in Japanese as *gitaigo* (擬態語), literally "state-mimicking words" (Akita 2009). Gitaigo words need not, and often do not, correspond to any "hearable" phenomenon (Hamano 1998). These forms differ from the "descriptive" class of sound effects explored in Study 1 in that gitaigo is meant to be an iconic representation. Descriptivity in sound effects, as we have defined it, is the use of symbolically representative words to describe an event as opposed to iconically representing the event with onomatopoetic words (e. g., *Explosion!* vs. *Boom!*). In contrast, both giongo and gitaigo are meant to iconically represent events or states; gitaigo, unlike descriptive onomatopoeia, does not use symbolically descriptive words from the Japanese lexicon.

A familiar pop culture example should help to clarify this distinction. The name of the yellow mouse character Pikachu that appears in Nintendo's *Pokémon* media is actually a combination of two gitaigo and giongo words describing the attributes of the character itself. The "Pika" part of the name comes from the gitaigo word "pika-pika," which refers to a sparkling quality. The "chu" is the giongo representation of the squeaking sound made by mice; analogous to the English word "meow" for the sound cats make.

The joining of these two words gives us "Pikachu," or "sparkling mouse," a befitting name for an electrically-charged rodent. It is crucial to understand, however, that this description is different than simply writing the Japanese words for "sparkling" and "mouse." It is a combination of two different types of iconic representations for the states and sounds of "sparkling" and "mouse noises."

As in Study 1, we compared these and other features of sound effects in the two predominant genres of Japanese manga: shonen and shojo. The line between these "genres" or "demographics" is not always an easy one to draw (Ito 2005), but we have adopted the most common distinction that the genre of any particular work is determined by which readers a magazine is marketed to (Brenner 2007; Gravett 2004; Schodt 1983; Drummond-Mathews 2010; Prough 2010). Shonen works, though enjoyed by people of all walks of life, are primarily marketed to teenage boys in Japan (Allen and Ingulsrud 2005). Their stories typically involve battle and friendship; fantastical elements like magic and swordsmanship, or superhuman feats of strength and other themes involving physical conflict (like sports). Protagonists are almost always male and female characters usually occupy maternal or amorous roles. In contrast, shojo manga is typically read by only women, and they are marketed primarily to teenage girls. Though some may include adventurous themes, they deal with the emotional and psychological states of their characters. Thus, stories are typically of every day love between a female protagonist and the men in her life. Settings are much more frequently "slice-of-life," e. g., high schools or workplaces (Natsume 2003; Schodt 1983; Ito 2005).

Existing research has confirmed that the two genres differ in many regards, from the demographics of their readers, to their themes, and even in their usage of conventional visual signs (Cohn and Ehly 2016). Because of these gross differences, we therefore hypothesized that we would find variations in each genre's treatment of sound effects.

## Methods

### Materials

Our analysis focused on two types of manga: shojo and shonen. The works we have designated as "shojo" come from two magazines marketed to young women in their late teens and early twenties. We included both older works and recently published material. All works were published within the past 10 years (2005–2015). A full listing of materials is provided in the Appendix.

### Areas of analysis

The same areas of analysis were used in Study 2 as in Study 1. However, certain additional fields were added to the "Content" subcategory due to particular traits of the Japanese language and its writing system. First, we coded for which of the four Japanese scripts the sound effects was written in: hiragana, katakana, kanji, or romaji. Second, rather than identify sound effects with the categories of "onomatopoeia" and "descriptive," we used the Japanese categories of giongo and gitaigo, as discussed above. Our distinction in coding between giongo or gitaigo used a criterion of "hearability." We supplied our own criterion for distinguishing between giongo and gitaigo because there does not exist a consistent or easily applicable distinction, and because we wished to draw, as much as possible, a line between the two categories that was analogous to that which separates onomatopoeic and descriptive sound effects in American comics. Is the phenomenon being represented by the particular instance of sound effect in question hearable? If so, the imagery was designated as giongo. If the phenomenon was not hearable, it was designated as gitaigo.

**Data analysis**

The same methods of data analysis were used in Study 2 as in Study 1.

## Results and discussion

As depicted in Figures 3 and 4, shonen and shojo manga differed across dimensions of both content and presentation. With regard to content, we found that shojo manga used hiragana and katakana in roughly equal proportion in the writing of sound effects, but shonen manga used katakana far more than hiragana (Figure 4). Shojo manga used hiragana much more than shonen manga, $t(18) = 5.38$, $p < 0.001$, while shonen manga used katakana more than shojo manga, $t(18) = -5.37$, $p < 0.001$. Neither genre used kanji for sound effects, and only one shojo manga used a few instances of romaji.

Shojo manga used significantly more gitaigo than shonen manga, while shonen tended to use more giongo than shojo manga (Figure 3). While shojo manga used more animate roots, shonen manga used more inanimate roots. These findings align with the higher proportion of non-sentient carriers used in shonen manga, while public carriers were found more often in shojo manga. Finally, with regard to presentation we found that spikey edged carriers were used more often in shonen manga, while compositionally enclosed carriers were used more in shojo manga.
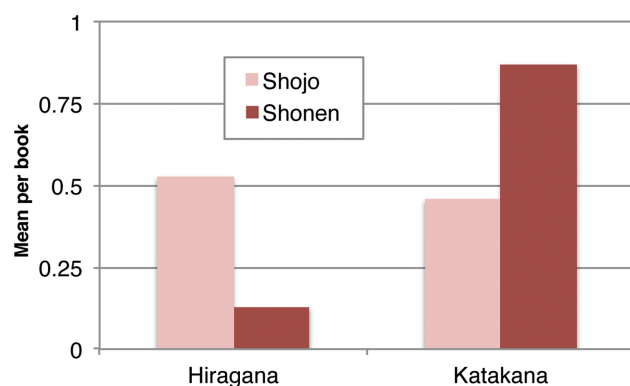


**Figure 4:** Proportion of sound effects using hiragana and katakana scripts in shojo and shonen manga.

## Cross-cultural comparison

Finally, we asked whether these features might differ between cultures, and thus collapsed across genres to compare the characteristics of sound effects between American comics and Japanese manga (Table 1, Figure 3). Several differences arose between cultures. Onomatopoetic/giongo sound effects were more prevalent in American comics than Japanese manga, while the reverse was the case for descriptive/gitaigo sound effects. Public carriers were used more in American comics than Japanese manga, while the reverse was true of non-sentient carriers. Relatedly, more animate roots appeared in Japanese manga while inanimate roots were used to higher proportions in American comics.

While many surface features of carriers did not differ between genres within cultures, they did between cultures. Japanese manga used more smooth edges, rectangular boxes, and wavy edges, while American comics used more compositionally enclosed sound effects. Both tails and links between carriers were far more preferred in American comics. Stylized fonts appeared more often in both genres of manga.

# General discussion

In two studies, we examined the treatment of sound effects in "comics" across dimensions of genre and culture. Our first study compared sound effects in genres of American mainstream and independent comics, while our second study compared genres of shonen and shojo manga from Japan. In both, we found significant differences across the content and presentation of sound effects, most prominently with regard to the lexical category of words used as sound effects. Altogether, our findings support the idea that genres can be distinguished by a variety of features that characterize the ways in which they use sound effects. Below, we elaborate on our findings regarding these features across our two main categories of analysis: content and presentation.

Our most prominent findings in both studies related to differences in content. Foremost among these was the fact that the predominant lexical category of sound effects in a book varied significantly between genres. In American comics, we found that onomatopoeic sound effects were used more in both mainstream and independent works, while descriptive sound effects were completely absent from the mainstream genre, and were rare in the independent genre. For Japanese manga, shonen manga used more giongo, while shojo manga used more gitaigo. These differences provide corpus-based evidence that the semantic content of sound effects differs between these genres. Sound effects function at the intersection of meaning from a variety of different modalities at once – they are tied to the visual content of the image (an image featuring an explosion could be expected to have a sound effect related to this, e. g., *Boom!*) and yet are primarily verbal in nature. This emblematic function allows us to use sound effects as an additional signpost in characterizing the works they appear in.

In American comics, superhero comics are the "mainstream." We may also consider onomatopoeia as a standard form of "sound effect," given that it is literally a word designed to approximate a sound. Indeed, our analysis found no descriptive sound effects in mainstream American comics, though based on other reports we can speculate that they are not entirely absent, and do exist in the genre, albeit in very minimal proportions (Guynes 2014). The overwhelming lack of descriptive sound effects in mainstream books at least somewhat validates them as being non-normative. After all, they do appear to a certain extent in independent comics, books that in part are defined by their departure from the mainstream. Writers have described independent comics as seeking to "push back the thematic horizons of the art form," "a radically new kind of expressive object," and wholly "nontraditional" (Hatfield 2005; Griffin 1998). Hatfield (2005) in particular argues that part of the ethos behind the independent genre is a desire to extricate the notion of the comic as an art form from the narrow, "mechanical" superhero comic book. We therefore posit that descriptive sound effects may be one additional way that independent comics attempt to diverge, to mark themselves as "out of the norm" – as different than mainstream American comics.

In the case of Japanese comics, the fact that shonen manga is dominated by sound effects describing inanimate objects, such as hearable sound effects like *boom* and *bang*, supports ideas about the content of shonen manga. Shonen manga is typically thought to feature stories of fantasy and fancy, action and physicality (Natsume 2003; Schodt 1983; Ito 2005). Our findings of greater usage of giongo in shonen manga supports this characterization: the genre pairs noisy, clamorous events with noisy, clamorous sounds. Similarly, our finding that shojo manga is dominated by sound effects generated by animate objects and characters, most of which communicate to the reader the emotional or physical state of the object, supports the prevailing conception of shojo manga – that it features stories that deal with the emotional and psychological states of their characters, stories of relationships and love (Natsume 2003; Schodt 1983; Ito 2005).

The second-most salient content-based finding was limited to Japanese works: shonen and shojo manga differed in the scripts they used to write sound effects. While both genres used both scripts, shonen manga featured far more katakana, whereas shojo manga featured more hiragana. Here again we believe that this choice is influenced by the content and intended audience of each genre: katakana, which dominated shonen, is a script that was, at one time, reserved for military directives and declarations of

war – an alphabet of action (Tsuchimochi 1991). On the other hand, hiragana, which was far more prevalent in shojo works, is an everyday script developed in ancient Japan by women and for women (Inoue 2002).

In contrast, English is written in only one script, and therefore lacks a truly analogous way to express the semantic distinctions represented by script choice in Japanese. In fact, there has been significant investigation into the difficulty of translation of Japanese sound effects into other languages (Flyxe 2002; Inose 2007; Sell 2011); while this relates to the difference in the onomatopoeic lexicons of English and Japanese (i. e., the unique category of gitaigo), we believe that translation difficulty also arises from an inability to express semantically meaningful script changes in English or other Latinate-alphabet languages that only have one written script. That is, because English lacks a true analogue for the semantically meaningful element of script choice, part of the socio-semantic information encoded in a Japanese sound effect is unavoidably lost in translation.

Nevertheless, American works may use means other than script choice to compensate for these types of contrasts. For example, we found no difference in the proportion of stylized and non-stylized text between Japanese genres, but this contrast was significant between American genres. More specifically, almost all sound effects were stylized in Japanese works, irrespective of genre. However, a significant portion of sound effects in American works were non-stylized, and the proportion of stylized/non-stylized effects was both significantly different between American genres and when compared to Japanese works as a whole. Independent comics used non-stylized text far more often than did mainstream ones. Forceville (2013) offers examples of stylized text being used both as part of onomatopoeic words and as part of regular text in several different types of Western-style works (American and European), including the superhero comic *Avengers*, an issue of which was included in our corpus. Of all the works examined by Forceville, this comic had the greatest percentage of stylized typography. He posits that the stylization of the typography adds extra semantic information to the text itself, e. g., "dancing" text (where letters are tilted and kerned irregularly to give the impression of motion) conveys a feeling of energy (Forceville 2013; Forceville et al. 2010). These findings largely coincide with our own. We therefore surmise that the semantic information encoded by differences in script choice in Japanese manga is not entirely absent from American comics, but is perhaps expressed in a different way.

Root animacy is the final content area in which we found a significant difference between American and Japanese works. American works differed little in their proportions of inanimate and animate roots; independent comics had almost exactly half animate and half inanimate roots. However, shojo manga had a significantly greater proportion of animate roots when compared to that of shonen: more than 80 % of roots in shojo manga were animate. This ties back to the fact that sound effects in shojo were primarily of the gitaigo lexical category. As discussed previously, gitaigo is used to communicate the state of existence of an object or entity; it is far more likely for the sound effect descriptor of an animate object to be gitaigo than it is for it to be giongo. We can also link this greater animacy to the content of the stories in shojo manga, which, as discussed above, are often about relationships between people and explorations of their emotional and psychological states (Natsume 2003; Schodt 1983; Ito 2005).

We also found differences with regard to the presentation of sound effects: their surface features. First, books differed with regard to being compositionally enclosed; that is, presence or absence of a written balloon on the page enclosing or containing the sound effect. American mainstream comics used high proportions of compositionally enclosed sound effects, as did shojo manga in Japanese comics. Both American independent comics and Japanese shonen manga included greater proportions of other bubble types than did mainstream comics or shojo manga. Nevertheless, for all genres, compositional enclosure was the most common way in which sound effects were presented on the page, and the most common "balloon type" was no balloon at all. We believe that these findings establish that for each of these genres, the "standard" bubble type is the absence of one, i. e., compositionally enclosed text. This finding echoes other work which has speculated that different genres have preferences for a standard or default surface representation for various types of carriers (Forceville et al. 2010).

We also found that both tails and linkages between carriers are present more in American comics than Japanese manga, though their proportions do not seem to differ between the genres within these cultures.

Both of these features make the relations between elements more explicit: Tails specify the connection to a root, and linkages specify connections between carriers. In situations where multiple roots are present, tails serve an important role in distinguishing whose "speech" belongs to whom. Such indexicality poses an interesting computational challenge as well, and procedurally generated comics take great pains to precisely draw tails to accurately connect carriers to their roots (Kurlander et al. 1996).

Our data indicates that the lower proportion of tails and linkages means that American comics make these connections overt, while Japanese manga leave them implied. This means that Japanese readers must do more to infer the root than American readers, and must also infer the reading path between carriers more than American readers, a challenge recently explored at length by computational modeling (Cao et al. 2014; Kovanen and Aizawa 2015).

As one of the first corpus analyses of sound effects – and of multimodal interfaces in general – in genres of comics, we can foresee additional studies that would build on these results. First, similar analyses can be applied to works from other genres and countries for an even wider scope of analysis. America and Japan alone have other genres beyond those studied here, and analysis of these could further enrich our interpretations. For example, beyond the shonen and shojo genres, which are ostensibly aimed at younger readers, manga are also written for and marketed to adult men and women. Might we find that the differences between genres aimed at different genders in Japan (discussed here) are also reflected in differences genres aimed at different age groups? Additional corpus analyses can shed light on these and other questions raised by our work.

There are also aspects of sound effects that we chose to exclude from our analysis. For example, we simplified the highly variant aspects of text stylization to a binary distinction; there is undoubtedly much left unsaid regarding the semantics of text stylization, as in Forceville's (2013) comments about "dancing letters." In addition, we have not addressed issues of punctuation, which undoubtedly plays an important role in written English (Baldwin and Cody 1978; Nunberg 1990). Could it serve a similar role in the domain of English sound effects? We did not delve any deeper into this question because Japanese and English orthography is quite different, and we sought to use (as much as possible) cross-culturally comparable criteria in our investigation.

Our results also open up additional questions about the comprehension of these sound effects. Comics do not exist in isolation as socio-cultural works, but are rather created for and comprehended by actual people, which means that we must be sensitive to the cognition that goes into understanding their verbal and visual languages (Cohn 2013b). Given the importance of the multimodal role they play, and the fact that they appear in significantly different proportions in works of different genres, we might ask whether our observed differences in sound effects across genres manifest in differences in comprehension. Research has already argued that common forms of communication like verbal quotation are inherently multimodal, and this multimodality informs their comprehension and production (Blackwell et al. 2015). Following this line of reasoning, would there be differences in the way readers process sound effects of different lexical categories (e. g., onomatopoetic/descriptive)? Would a sound effect be processed differently based on its script or text stylization? Such questions would benefit from interfacing with methods from experimental psychology, and such projects are already underway (Manfredi et al. submitted).

This corpus analysis revealed several differences in both content and presentation between sound effects in genres of American comics and Japanese manga. Overall, we found that content-related features were more variant than those related to presentation; save minor differences, sound effects across genres in any particular culture have very similar surface-level representations. This helps them perform their role as multimodal signposts most effectively. The quantity and importance of the different types of information they carry necessitates that they be easily visually distinguishable from the other elements of the visual narrative. In other words, sound effects within a culture are visually similar because readers need to be able to locate and identify them quickly and accurately. Visual similarity in sound effects ensures that the primary bearer of the information of a sound effect its content, not its presentation. In particular, our data suggest that we can use the properties of sound effects' content in any particular genre as one way to broadly classify and understand the content of that genre's works.

# Appendix: Works analyzed

## American mainstream

Cho, Frank. (2005). *Shanna, the She-Devil*. Marvel. Issue 1.

Conway, G., Andru, R., & Giordano, D. (1976). *The Battle of the Century: Superman vs. The Amazing Spiderman*. DC Comics and Marvel. Prologue.

Heinberg, Alan & Cheung, Jim. (2005). *Young Avengers*. Marvel. Issue 1.

Hine, David & Gaydos, Michael. (2005). *Daredevil: Redemption*. Marvel. Issue 1.

Hine, David & Yardin, David. (2004). *District X*. Marvel. Issue 3.

Loeb, J., Lee, J., & Williams, S. (2002). *Batman: Hush, Volume 1*. DC Comics. Chapter 1.

Miller, F., Varley, L., & Jaunson, K. (1986). *Batman: The Dark Knight Returns*. DC Comics. Chapter 1.

Moore, A., Bolland, B., & Higgins, J. (1988). *Batman: The Killing Joke*. DC Comics.

Taylor, T., Redondo, B., & Hugonnard-Bert, J. (2014). *Injustice: Gods Among Us: Year Two*. DC Comics. Issue 1.

Vaughan, Brian, et al. (2001). *Ultimate X-Men*. Marvel. Issue 50.

## American independent

Adkins, Leuwin & Shelton, Gilbert. (1972). *Jesus Comics No. 3*. Rip Off Press. Craddock's Crusade.

Boivin, Jacques. (1988). *The Complete Fluffhead*. Phantasy Press. Fluffhead.

Cannon, Kevin. (2009). *Far Arden*. Top Shelf. Chapter 1.

Chevat, Richie & Ewing, Dean. (1982). *The Ronnie Rat Show*. Ink Works. Sleep Wid Da Fishes.

Deitch, Kim. (1978). *Banzai!* Kitchen Sink Enterprises. Noodles' Punctured Romance.

Greenwood, Warren & Von Sholly, Pete. (1973). *Zero, No. 1*. Greenwood Organization. Shadows Over Happy Times, or Broccoli Unchained.

Griffin, Rick. (1968). *ZAP, No. 2*. Apex Novelties. Hike.

Nicholson, Jeff. (1986). *Ultra Klutz, No. 4*. Onward Comics. Chapter 5.

Sim, Dave. (1987). *Cerebrus, Volume 1*. Aardvark-Vanaheim. The Flame Jewel.

Todd, Mort & Clowes, Dan'l. (1987). *Twist, No. 1*. Kitchen Sink Enterprises. Shelter Skelter.

## Japanese Shonen

Amano, Akira. (2012). *Katekyo Hitman Reborn*. Shueisha. Chapter 382.

Hideaki, Sorachi. (2013). *Gintama*. Shueisha. Chapter 448.

Kishimoto, Masashi. (2012). *Naruto*. Shueisha. Chapter 583.

Kubo, Tite. (2012). *Bleach*. Shueisha. Chapter 490.

Mashima, Hiro. (2014). *Fairy Tail*. Kodansha. Chapter 385.

Nanatsuki, Kyouichi & Yang, Kyung-Il. (2013). *Area D*. Shogakukan. Chapter 38.

Shimabukuro, Mitsutoshi. (2014). *Toriko*. Shueisha. Chapter 266.

Togashi, Yoshihiro. (2014). *Hunter x Hunter*. Shueisha. Chapter 342.

Yagi, Norihiro. (2012). *Claymore*. Shueisha. Chapter 132.

Yoshiki, Tanaka & Arakawa, Hiromu. (2014). *The Heroic Legend of Arslan*. Kodansha. Chapter 9.

## Japanese Shojo

Aoyama, Haruno. (2011). *Kawaikunai I*. Shueisha. Chapter 1.

Fujii, Aya. (2014). *Warui Hito*. Shueisha. Chapter 1.

Hashiba, Mao. (2014). *Hoshi no Ko*. Shueisha. Chapter 1.

Meguro, Amu. (2012). *Honey*. Shueisha. Chapter 1.

Robiko. (2008). *Tonari no Kaibutsu-kun*. Kodansha. Chapter 1.

Saori. (2014). *Warui Otoko*. Shueisha. Chapter 1.

Shiina, Karuho. (2005). *Kimi ni Todoke*. Shueisha. Chapter 0.

Shiro, Ayane. (2013). *Charlotte*. Shueisha. Chapter 1.

Taamo. (2011). *Taiyou no Ie*. Kodansha. Chapter 1.

Yanai, Wakana. (2014). *Mofuku no Angel*. Shueisha. Chapter 1.

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