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### An experimental study on the effect of emotion lines in comics

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**An experimental study on the effect of  
emotion lines in comics**

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**Abstract:** Both mainstream and art comics often use various flourishes surrounding characters' heads. These so-called “pictorial runes” (also called “emanata”) help convey the emotional states of the characters. In this paper, using (manipulated) panels from Western and Indian comic albums as well as neutral emoticons and basic shapes in different colors, we focus on the following two issues: (a) whether runes increase the awareness in comics readers about the emotional state of the character; and (b) whether a correspondence can be found between the types of runes (twirls, spirals, droplets, and spikes) and specific emotions. Our results show that runes help communicate emotion. Although no one-to-one correspondence was found between the tested runes and specific emotions, it was found that droplets and spikes indicate generic emotions, spirals indicate negative emotions, and twirls indicate confusion and dizziness.

**Keywords:** comics' symbols; emanata; emotions; pictorial runes; visual communication

## 1 Introduction

The concept of a “code” is central to semiotics. As Chandler points out in his handbook, “[c]odes are ... regarded as central in communication and representation. Since the (intended) meaning of a sign depends on the code within which it is situated, codes provide a framework within which signs make sense” (2017: 179). To the extent that information is coded, it has a conventional meaning, the correct interpretation of which requires that the interpreter has *learned* the pertinent code. The meaning of coded information is (much) less dependent on specific contexts than non-coded information, the meaning of which needs to be *inferred* (for more

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discussion on the relation between (de)coding and inferring, see Forceville 2020: 42–49; 74–80).

In semiotics, different types of codes are usually distinguished, one subtype being “perceptual codes: e.g., of visual perception” (Chandler 2017: 186). Whereas it is uncontroversial that the interpretation of language is highly governed by codes, the question whether visuals can be said to have a “grammar” (Leborg 2006) is hotly debated (e.g., see Kress and Van Leeuwen 1996, criticized by Forceville 1999). Our view is that visuals by and large have structure, but not grammars in the highly specific sense that languages do. This being said, there are certain visuals that are governed by visual codes, and thereby constitute visual symbols in the Peircean sense (see Chandler 2017: 41), and thus have a precise, conventional meaning. An example are traffic signs (see Forceville and Kjeldsen 2018).

Given that coded information is more explicit and precise than information that can only be inferred (and whose interpretation is thus more context-dependent and subjective), it is a highly worthwhile semiotic project to analyze which (kind of) visual information is governed by perceptual codes.

We focus here on one specific aspect in the medium of comics, the coded nature of which we test empirically: the use of various lines or “flourishes” surrounding comics characters’ heads to help the reader understand that these characters experience a certain emotion. So-called “emotion lines” are part of a number of stylistic devices open to comics artists to convey characters’ emotions. A provisional list of such devices (see, e.g., Cohn 2013; Forceville 2005, 2011a; Forceville et al. 2014; McCloud 1993; Stamenković et al. 2018) is the following:

1. verbal utterances, that is, by things they themselves say (e.g., “I am angry,” “AAARRRRGH”) or that an external narrator observes (e.g., “Captain Haddock is angry”);
2. facial expressions, often exaggerated (e.g., smiles, frowns, clenched teeth);
3. bodily postures, often exaggerated (e.g., shaking, warding off, clasped hands);
4. more or less conventionalized pictograms surrounding characters’ head and bodies, or instead in their text balloons (e.g., hearts, skulls, musical notes);
5. formal features of text balloons and panels (e.g., forms, use of colors, font types);
6. the flourishes surrounding character’s heads and bodies, called “pictorial runes” by Kennedy (1982: 600), “emanata” by Walker (2000 [1980]), and “emotion lines” in this paper.

These techniques are neither mutually exclusive – indeed, often many elements are used to communicate the emotional state of a character to the reader – nor are they exhaustive; and sometimes it may not be clear as to the category in which a

given feature belongs. However, they provide a useful initial framework for analysis.

Though both comic practitioners (Eisner 1985; McCloud 1993; Walker 2000) and scholars writing about comics (Cohn 2007, 2013, 2020; Gasca and Gubern 2001 [1994]; Saraceni 2003; Tan 2001) comment on one or more of these ways for conveying emotions, there is little systematic research on this topic (Forceville et al. 2010; Fresnault-Deruelle 1972, 1977). For example, it is still not clear what is the role of individual elements in the overall experience of emotions in comic readers.

We are concerned with “pictorial runes,” which are defined as “non-mimetic graphic elements that contribute narratively salient information” (Forceville 2011a: 875). Examples of pictorial runes are lines behind a moving character to indicate movement and/or speed and a semi-circle of droplets around a character’s head to suggest she is emotionally affected. Pictorial runes are to be distinguished from pictograms, which are conventionalized *mimetic* graphic elements, such as ♪, ♥, and \$; pictograms, thus, are stylized versions of entities that have a rudimentary meaning we know from outside the realm of comics.

In recent years, some studies within the Conceptual Metaphor Theory paradigm have been done to explore how runes convey emotion in comics (Abbott and Forceville 2011; Eerden 2009; Forceville 2005, 2011a; Shinohara and Matsunaka 2009; Szawerna 2017; see also Forceville 2011b for a survey of unpublished research conducted by students). These authors have studied issues like: Do pictorial runes constitute a limited set? Are there any systematic rules for combining them with each other and with other emotion-conveying elements? Are there any common patterns of runes across artists, periods, movements and cultures? Is there an underlying logic to the forms of the runes: were they arbitrary signs originally that gradually became conventionalized symbols or is there another rationale underlying their form? Are different types of runes clearly distinguishable and do they have a generally fixed meaning? An answer to the last question particularly has implications beyond the domain of comics, and could provide useful information about the relationship between visual forms and emotional expressions.

The goal of this paper is to empirically test the claim that pictorial runes convey systematically patterned information about emotional state of the characters. The experiment is based on the theoretical framework of Forceville (2011a), where all the pictorial runes that occurred in the 755 panels of *Tintin and the Picaros* (first published as *Tintin et les Picaros*, 1976) were inventoried, analyzed, and cataloged with respect to their purported meaning (Figure 1).

Forceville (2011a) argued that droplets, spikes, spirals, and twirls, in combination with the other signals mentioned in the above list, are all used to convey

Pictorial rune	Name for rune	Typical location and orientation
	Speed lines	Behind or parallel to a person or object, often indicating direction.
	Three types of movement lines	In various orientations around or parallel to a body part or other object.
	Droplets	In multiples in halo-like fashion around a person's head.
	Spikes	In multiples in halo-like fashion around a person's head or other object.
	Spiral	Usually in multiples in halo-like fashion around a person's head, sometimes singly, parallel to a body part.
	Twirl	Usually single, appearing more or less horizontally behind an agent or vertically above a person's head.

**Figure 1:** Pictorial runes analyzed by Forceville (2011a: 877).

emotional states of comic characters: “runes could be metaphorically seen as graphic equivalents of what in language are bound morphemes” (Forceville 2011a: 877; see Engelhardt 2002: 24 for introducing this distinction for visual information). The range of emotions that droplets were found to convey included surprise, consternation, anger, anxiety, and fear, leading to the conclusion (in the case of droplets), that “it is not always possible to pinpoint the precise emotion(s) communicated in a specific panel” (Forceville 2011a: 879). When spikes were used to convey emotion (other uses of spikes were suggesting sound or noise and drawing attention to a salient object), their meaning “appears to be similar to that of runic droplets: generic affect” (2011a: 879). By contrast, spirals, when they signaled affect (they could also suggest sound and music), seemed to have a more specific meaning, “convey[ing] a generically negative emotion, such as anger, disgust or frustration” (2011a: 880). The twirl, when used next to a character’s head, was deemed to have a somewhat more specific meaning, signaling “dizziness, drunkenness, confusion or unconsciousness” (2011a: 882).

Though the rune catalog was largely based on an analysis of *Tintin and the Picaros*, it was claimed – based on a brief, non-systematic consideration of comic panels by other artists – that these runes were in general used by a variety of (Western) artists, and not by Hergé alone. However, if we consider whether runes have a universal meaning, it is possible that the meaning of runes may be partly dependent on the readers’ familiarity with specific comic characters. Forceville

(2011a) analyzed several runes and hypothesized corresponding emotions for them. Based on his analysis and an unpublished pilot study (Ojha et al. 2012), we propose the following hypotheses for this empirical study:

1. The use of all four runes (droplets, spikes, spirals and twirls) around a character's head is taken to mean that the character under consideration is emotionally affected.
2. Droplets and spikes denote generic emotions; spirals denote negative emotions such as anger; and twirls denote confusion.
3. Readers familiar with comic characters are as consistent in attributing emotions to runes as readers who are not familiar with comic characters.

## 2 Methodology

As mentioned above, emotions in comics can be evoked by using various stylistic elements besides pictorial runes, such as background color, forms of text balloons, facial expressions, and body postures. Testing the role of runes alone presents several methodological problems, as it is difficult to isolate runes from their original settings. Attempting to pinpoint the role of pictorial runes in evoking emotion necessitates the removal, or at least controlled reduction of other elements. Therefore, we tested runes in the following three conditions

### 2.1 Actual comic characters

Runes mostly appear with comic characters and are used to convey the emotional state of the characters around whose heads they appear. Therefore, we tested four emotion-related runes – namely spikes, spirals, twirls, and droplets – in actual comic characters in isolated panels. On the basis of conclusions derived from the analysis of *Tintin and the Picaros*, we speculated that not only Western artists, but also artists in different cultures use runes and that they carry the same meaning. That is, emotions evoked by a particular rune in Tintin characters are likely to evoke the same emotion when appearing around the heads of characters in different cultures. However, Ojha et al. (2012) found that, contrary to Forceville's (2011a) expectations, both cultural upbringing and familiarity with characters influences the understanding of runes. We think there are two reasons for this. First, if readers are used to reading comics in a particular culture, then they are also used to understanding the meaning of runes that are exclusively (or: uniquely?) used in that culture. Second, even if readers are not used to reading comics, the fact

that comic characters and their actions are from the same culture and the readers can relate to them may influence what emotional states are seen in a comic character. To study the effect of a particular artist's style and of one's cultural background on the emotions assigned to a comic character, we conducted an empirical investigation using comic characters drawn by four different artists: two from Europe, Hergé and Uderzo; and two from India, Pran and Vasant Halbe.

Moreover, in order to minimize the effect of various other elements in the comic panels, such as characters, dialogue balloons, language, facial expressions of characters, the following constraints were further imposed:

1. To reduce the effect of features associated with specific characters, five different characters (all human) from each artist's work were chosen.
2. Characters with no or minimal facial expressions were chosen to avoid cueing emotions by non-runic means.
3. To reduce the effect of information in text balloons, most of the characters were not speaking in the panels used in the experiment.
4. Panels in English and Hindi were presented in Dutch and Bengali in order to reduce the effect of language on the assumption that, given that the participants in the experiments were Hindi-speaking Indians, they had no command of Dutch and Bengali.

## 2.2 Neutral emoticons

One can argue that despite controlling various factors in an actual comic panel, facial expressions and bodily postures of comic characters cannot be removed completely, and they may have some influence on the emotions attached to the characters. Therefore, we also tested the four runes with neutral emoticons, which are less likely to show facial expressions but still provide basic facial features. We chose neutral emoticons in five different colors (red, blue, yellow, green and white) as the color of emoticons may also influence the emotion seen in the character.

## 2.3 Basic shapes and colors

It might still be objected that the presence of face-like features in emoticons is in itself enough to evoke emotions. So, although the use of emoticons may reduce the effect of facial features and body postures, they do not completely annul it. Basic facial features, even when consisting of mere eyes and mouths, may still influence the emotional states associated with comic characters. Therefore, to further reduce the

effect of face-like features, we also tested runes with basic shapes (circle, triangle, square, star, and pentagon) in different colors (red, blue, yellow, green, and white).

## 2.4 Selecting emotions

There is a large range of emotions: some emotions overlap and sometimes it is difficult to completely distinguish one emotion from another. For example, happiness may include other emotions such as excitement, joy, pleasure, etc. Similarly, anger may include pain, disgust, irritation, etc. Therefore, to decide how to *label* emotions triggered by certain runes is a methodological issue in itself (Ojha et al. 2012; see also Stamenković et al. 2018). Then there are several models of emotions. Paul Ekman followed the Darwinian tradition and identified six universal emotion categories (Ekman 1993): anger, disgust, fear, happiness, sadness, and surprise. Plutchik (1980) proposed eight basic emotions: anger, fear, sadness, disgust, surprise, curiosity, acceptance, and joy. Lang proposed a two-dimensional model of emotions based on arousal and valence values (Lang 1995). In our study, we used the four emotion categories based on Forceville's analysis of *Tintin and the Picaros* (2011a): confusion, anger, surprise and agitation.

## 3 Experiments

The experiment was conducted in two stages. In the first study, the selected runes were tested using as stimulus material actual comic characters from India, Belgium, and France. In the second study, runes were tested using as stimulus material neutral emoticons and five different shapes in five different colors. Moreover, participants in both the studies were divided into two categories based on their familiarity with comic characters: (1) familiar with comic characters (FC) and (2) not familiar with comic characters (NFC). The two studies of the experiment were conducted with different sets of participants. A total of 450 participants participated in the study, 250 of whom were familiar with comic characters and 200 of whom were not familiar with comic characters.

### 3.1 Study 1: Using actual comic characters

#### 3.1.1 Participants

Two-hundred Indian participants (105 females and 95 males; Mean age = 25.6, SD = 10.2 years) participated in this study. They were divided into two groups

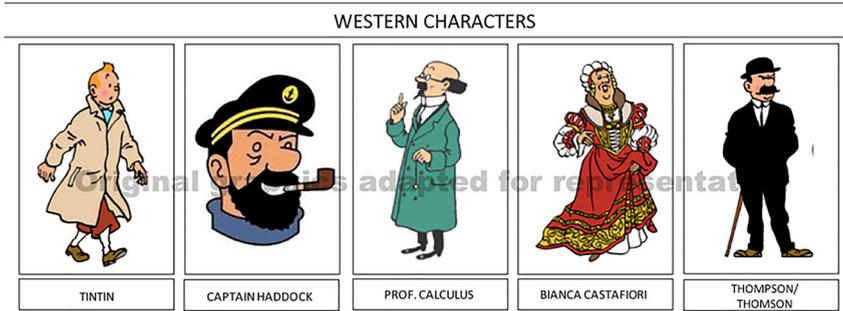
depending on their familiarity with comic characters in general in the following way: (1) Participants familiar with comic characters (45 females and 55 males) and (2) participants not familiar with comic characters (60 females and 40 males). A set of 25 questions was given to each participant at the beginning of the experiment. The questionnaire was divided into two parts. Part 1 of the questionnaire had 10 questions related to the Tintin and Asterix comic series and their characters (for example, “what is the occupation of Tintin?” “Who was the Roman emperor during Asterix’s time?”). Part 2 contained 15 questions about Indian comics’ characters (for example, “what happens when Sabu gets angry?” “Chacha Chaudhary’s mind is compared to which machine?” “What is the name of Pinky’s pet squirrel?”). Participants who answered at least eight questions from part 1 and 12 questions from part 2 correctly were put in the first group, labeled “familiar with comic characters.” Participants who answered less than five questions in both part 1 and part 2 were put in the second group, labeled “non-familiar with comic characters.” Participants whose responses were between these two limits were not included in the experiment. The participants were then equally divided into five groups for a mixed-design experiment, with each group consisting of 40 participants.

### 3.1.2 Stimulus material

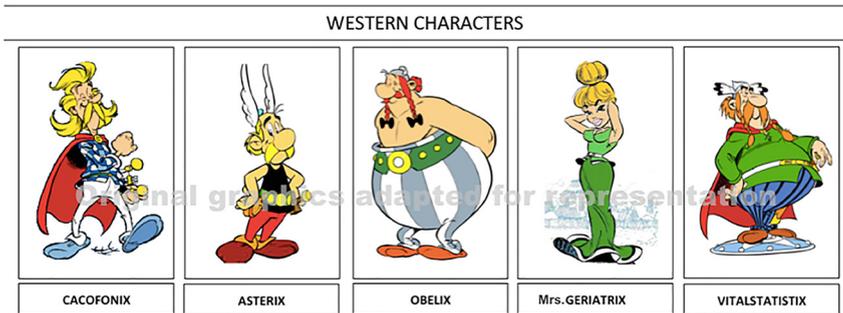
To generate stimulus material for this part of the study, four artists from Europe and India (Western comics: Hergé and Uderzo; Indian comics: Pran and Vasant Halbe) and five characters from each artist were chosen. The English names of these characters were used in the experiment:

- Characters chosen from Hergé: Tintin, Professor Calculus, Captain Haddock, Bianca Castafiori, and the pair of indistinguishable detectives Thompson and Thomson (Figure 2).
- Characters chosen from Uderzo: Asterix, Cacofonix, Obelix, Mrs. Geriatrix, Vitalstatix (Figure 3).
- Characters chosen from Pran: Chacha Chaudhari, Billu, Raman, Pinky and Sabu (Figure 4),
- Characters chosen from Halbe: Shikari Shambhu, Tantri, Supandi, Pyarelal, Bankelal (Figure 5).

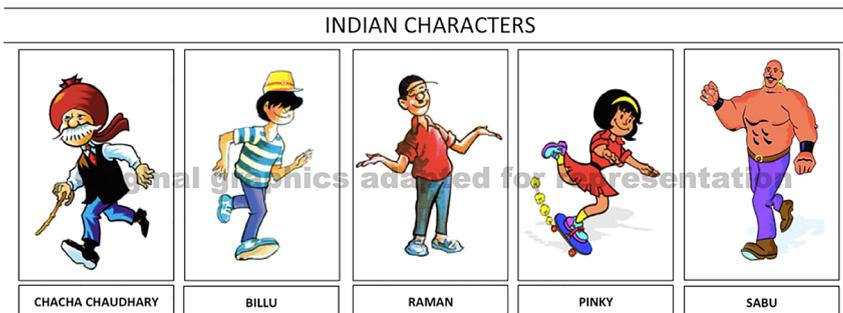
We chose five panels for each character, resulting in 25 different panels for each artist. Five copies of these 25 panels were created. Existing runes (if any) were removed from all the selected panels using the GIMP image tool, and an artist drew four different runes (spiral, spike, twirl, droplet) on the characters in four identical panels, to ensure a uniform style of drawing the runes. One panel for each character was left without runes and was called the “no-rune panel.”



**Figure 2:** Characters chosen from Hergé comics for the experiment.

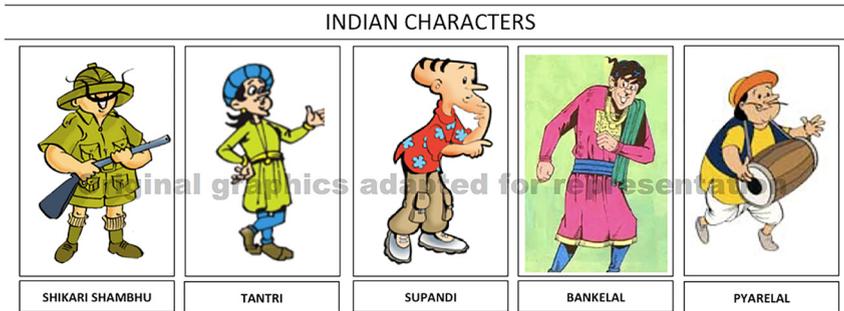


**Figure 3:** Characters chosen from Uderzo for the experiment



**Figure 4:** Characters chosen from Pran for the experiment.

This resulted in a set of five different panels of five different characters from one artist in five different rune conditions ( $5 \times 5 \times 5 = 125$ ). By doing this with all four artists we got 500 panels ( $5 \times 5 \times 5 \times 4$ ). These panels were then divided into five sets



**Figure 5:** Characters chosen from Tinkle (Halbe) for the experiment.

so that each set contained all four artists, all five characters, and all panels without any repeating runes. Then each set was made into a booklet, resulting in five booklets. These booklets were presented to five groups of participants. We followed a mixed-design format in which it was made sure that each character was presented in all the rune conditions, but not to the same participant.

### 3.1.3 Procedure

Participants were briefed about the experiment in the following way: They were first given a questionnaire to determine their familiarity with comics. The questionnaire was printed on a separate sheet, and was analyzed later during data sorting. Then they were given one of the five booklets. Each booklet consisted of 100 panels and for each panel the participant was asked to choose the best emotion from the list of five options: *anger*, *surprise*, *confusion*, *agitation* or *no emotion*. They were also allowed to mention another emotion, if they thought the characters showed an emotion that was not in the list. They gave their responses on a separate answer sheet, which also included their personal information, such as age and native language.

The stimuli were presented to the participants in print. This was done to keep the experimental conditions as close to natural as possible, for the participants were used to reading comics in print and not on a computer screen. The participants were allowed to take as much time as they needed.

### 3.1.4 Results

Table 1 shows the results for Indian and Western comics characters. We did not find any significant difference in the response between the categories “familiar with

**Table 1:** Results of participants judging Indian and Western comics. Collapsed for both groups of participants (familiar and non-familiar with comics). All the responses are given in percentages.

	Confusion	Anger	Surprise	Agitation	None/others
<i>Indian characters</i>					
Spikes	33.6	10.9	20.9	26.8	7.8
Spiral	18.6	8.1	<b>63.8</b>	5.5	4
Twirls	<b>49.2</b>	8.9	28.1	7.1	6.7
Droplets	<b>27.2</b>	8.2	<b>29.1</b>	33.1	4.4
None	3.5	3.7	3.6	3.5	<b>85.7</b>
<i>Western characters</i>					
Spikes	<b>26.1</b>	18.5	<b>26.7</b>	24	4.7
Spiral	16.2	7.1	<b>68</b>	5	3.7
Twirls	<b>57.4</b>	7.9	<b>19.7</b>	9.2	5.9
Droplets	<b>24.1</b>	18.4	<b>37.1</b>	16.8	3.6
None	7.1	2.9	4.9	2.4	<b>82.7</b>

Bold numbers indicate significant results.

comics” and “unfamiliar with comics.” Therefore, we collapsed these categories and present an average result. For Indian characters, spikes were found to be associated with confusion (33.6%), surprise (20.9%), and agitation (26.8%). Spirals were strongly associated with surprise (63.8%). Twirls were closely associated with confusion (49.2%). Droplets were associated with confusion (27.2%), surprise (29.1%), and agitation (33.1%). “No runes condition” indicated “no emotions” (82.7%) and other emotions (disgusted, happy) were 3%. A Pearson Chi-Square statistic suggested a significant correlation between the presence of runes and the judgment that a character is emotionally affected,  $\chi^2 = 403.69$ ,  $p < 0.001$ . We also conducted 2 (group: familiar vs. not-familiar)  $\times$  2 (culture: Western vs. Indian) repeated measures ANOVA. However, there was no significant effect.

For Western comics characters too, we did not find any significant difference in the responses between the two categories “familiar with comics” and “unfamiliar with comics”. For Western characters, spikes were associated with confusion (26.1%), surprise (26.7%), anger (18.5%), and agitation (24%). Spirals were strongly associated with surprise (68%). Twirls were associated with confusion (37.4%). Droplets were associated with confusion (24.1%), surprise (37.1%), anger (18.4%), and agitation (16.8%). The “no-runes condition” indicated no emotions (77.5%) and other emotions were (sad, happy) 5.2%. A Pearson Chi-Square statistic suggested a significant correlation between the runes and emotions,  $\chi^2 = 399.92$ ,  $p < 0.001$ . A 2 (group: familiar vs. not familiar)  $\times$  2 (culture: Western vs. Indian) repeated measures ANOVA revealed no significant effect of factors.

### 3.1.5 Discussion

This study included actual comic characters from Indian and Western comic series. All the participants were Indian. The results yield two important findings: First, there was no significant difference in the response between groups familiar and not familiar with comics. Second, the responses by participants were the same for Indian and Western comics characters. We did not find any significant effect of two factors (familiarity and culture) on the responses of participants. However, we did not compare results of men and women. Confirming our hypothesis we found that droplets and spikes were mostly associated with generic emotions, while spirals were associated with negative emotions. Twirls were associated with confusion and dizziness. The no-runes condition elicited a “no emotion” response.

## 3.2 Study 2: Neutral emoticon and shapes in five different colors

### 3.2.1 Participants

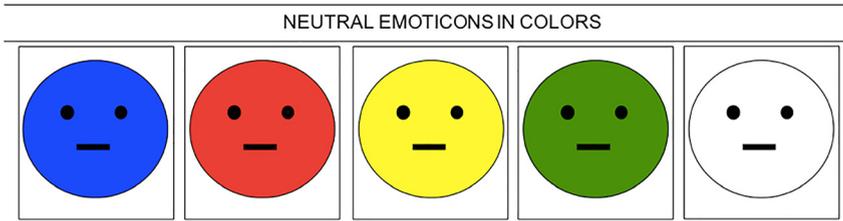
Two-hundred-and-fifty participants (125 females and 125 males; Mean age: 27.3, SD = 7.4 years) participated in this study. Following the exact same procedure as in the previous study, the participants were also divided into two groups: (1) familiar with comic characters (65 females and 85 males) and (2) not familiar with comic characters (60 females and 40 males). A set of 25 questions was given to each participant at the beginning of the experiment to place them in one of the two groups.

### 3.2.2 Stimulus material

Two different sets of stimuli were created for this part of the study. Instead of actual comic characters, runes were presented with a neutral emoticon and with five different geometrical shapes in five different colors.

### 3.2.3 Neutral emoticons in five colors

First to decide on a neutral emoticon, five different emoticons were presented to seven judges, who were asked to decide on the neutrality of the emoticons. On the basis of inter-rater agreement ( $\kappa = 0.7832$ ,  $p < 0.01$ ), the most neutral emoticon was selected. Then five versions of the selected neutral emoticon were created in five different colors (Figure 6). For each colored emoticon, five copies were created, and



**Figure 6:** Neutral emoticon in blue, red, yellow, green and white color.

an artist drew one of four different runes on each of four copies, leaving one copy without runes, which was called the “no-rune” emoticon. This gave us a total of 25 emoticons (5 colors  $\times$  5 runes), which were divided into five sets. Five booklets were created with each booklet containing five emoticons.

### 3.2.4 Basic shapes in five colors

To generate stimuli with basic shapes, we chose five different basic shapes: circle, triangle, pentagon, star, and square. These shapes did not have any facial features. Five copies of each shape were created in five different colors: blue, red, yellow, green, and white. For each single-color shape, five copies were created and an artist drew one of four different runes on each of four copies, leaving one copy without runes, which was called the “no rune” shape. This gave us a total of 125 shapes (5 shapes  $\times$  5 colors  $\times$  5 runes). They were further divided into five sets and compiled into five different booklets. Each booklet included 25 shape panels (Figure 7).

### 3.2.5 Procedure

As in the first study, participants were briefed about the experiment as follows. First, they were given a questionnaire to determine their degree of familiarity with comics. Then they were given one of the five booklets. Each booklet prepared



**Figure 7:** Square, star, circle, triangle and pentagon shapes in green, red, blue, yellow and white colors.

included 30 panels with runes and no runes conditions (25 shape + color panel and five emoticons + color panel). For each panel, the participants were asked to choose the best emotion from the list of five options: *anger*, *surprise*, *confusion*, *agitation* or *no emotion*. They were also allowed to propose another emotion if they thought that the panel showed an emotion that was not in the list. They gave their response on a separate answer sheet, which also included their personal information, such as age and native language. The stimuli was presented to the participants in print.

### 3.2.6 Results

Table 2 shows the average result of emoticons shapes in different colors. Since colors and shapes did not elicit different responses (except for the red color condition), we collapsed shape and color. We did not include the response to red color shapes and analyzed red color shapes separately, since they showed completely different results. We present the results of red color shapes in a different table (Table 3). The results for the other colors suggest that spikes were strongly associated with confusion (49.52%). Spirals were strongly associated with surprise (52.6%). Twirls were associated with confusion (38.36%). Droplets were associated with confusion (38.16%) and surprise (30.88%). “No runes condition” indicated “no emotions” (77.24%). A Pearson Chi-Square statistic suggested a significant correlation between the runes and emotions,  $\chi^2 = 363.13$ ,  $p < 0.001$ .

**Table 2:** Results of participants judging neutral emoticons (five colors) and shapes in four colors. Responses for shapes in red are not included, while they were collapsed for both groups of participants (familiar and non-familiar with comics). All the responses are given in percentages.

	Confusion	Anger	Surprise	Agitation	None/Others
<i>Neutral emoticons in all colors</i>					
Spikes	25.2	21.8	27.0	21.2	04.8
Spiral	13.7	09.8	<b>65.8</b>	04.9	05.8
Twirls	<b>51.6</b>	12.2	17.8	12.0	06.4
Droplets	25.4	16.8	32.4	21.4	04.0
None	07.6	09.4	03.4	02.0	<b>77.6</b>
<i>Shapes in all colors (except red)</i>					
Spikes	<b>29.52</b>	27.48	22.88	16.68	3.44
Spiral	21	17.14	<b>52.6</b>	5.16	4.1
Twirls	<b>58.36</b>	6.64	<b>18.8</b>	11.12	5.08
Droplets	<b>38.16</b>	18.4	<b>30.88</b>	9.2	3.36
None	6.08	9.48	3.84	3.36	<b>77.24</b>

Bold numbers indicate significant results.

**Table 3:** Responses of participants for five shapes in red color, given in percentages.

	Confusion	Anger	Surprise	Agitation	None
Spikes	20.6	<b>56.6</b>	10.8	6.6	5.4
Spiral	18	<b>55.2</b>	18.8	6	2
Twirls	20.6	<b>50.6</b>	15.8	9.4	3.6
Droplets	21.4	54	12.4	7.6	4.6
None	4	<b>32.4</b>	2.4	6.2	55

Bold numbers indicate significant results.

For neutral emoticons we found that spikes were strongly associated with confusion (45.2%). Spirals were associated with surprise (65.8%). Twirls were primarily associated with confusion (31.6%) and surprise (37.8%). Droplets were strongly associated with surprise (42.4%) and confusion (30.4%). “No runes condition” indicated “no emotions” (77.6%). A Pearson Chi-Square statistic suggested a significant correlation between the runes and emotions,  $\chi^2 = 369.28$ ,  $p < 0.001$ .

### 3.2.7 Red in different shapes

We calculated the responses to the red color condition in different shapes independently. Table 3 shows the results of red in all shapes suggested. Responses suggest that spikes (56.6%), spirals (55.2%), twirls (50.6%), and droplets (54%) are strongly associated with anger, with the exception of “no rune” panels, which are associated with “no emotions.” A Pearson Chi-Square statistic suggested a significant correlation between the runes and emotions,  $\chi^2 = 183.96$ ,  $p < 0.001$ .

### 3.2.8 Discussion

This part of the study explored which emotions are elicited if runes are presented in simple shapes with different colors and neutral emoticons. Emoticons presented basic face-like features, while simple shapes removed them all together. The results were similar to the results of Study 1. Droplets and spikes were found to be associated with generic emotions and spirals were associated with negative emotions. Twirls were associated with confusion. However, we also found that all shapes in red elicited anger. Other colors did not have any significant effect.

## 4 General discussion

The experiment confirms the general hypothesis that pictorial runes play a role in conveying emotions, as the presence of runes stimulates emotions significantly more often than their absence – irrespective of whether the stimuli were actual comic characters, neutral emoticons, or geometrical shapes. As hypothesized, we furthermore found that droplets and spikes denote generic emotions, while twirls were associated with confusion. However, anger was not found to be associated with any rune in particular. On the basis of our experimental results, we now reconsider the hypotheses that we presented in Section 1.

**H1:** *The use of all four runes (droplets, spikes, spirals, and twirls) around a character's head is understood as signaling that the character under consideration is emotionally affected:* This hypothesis is confirmed in all conditions. Moreover the hypothesis also gets confirmation from the fact that the “no runes” conditions produced “no emotion” responses. The moniker “emotion lines” for pictorial runes surrounding characters’ or pseudo-characters’ heads thus lives up to its name.

**H2:** *Droplets and spikes denote generic emotion; spirals denote negative emotions such as anger; and twirls denote confusion or dizziness:* Our hypothesis is partly confirmed. We found that spikes and droplets were associated with several emotions, indicating that they denote generic emotions, not specific ones. Twirls were found to be strongly associated with confusion. However, contrary to our expectations, we found that participants in all conditions failed to associate anger with any particular rune. So our hypothesis that anger is significantly more often cued by the spirals rune than by the other runes was disconfirmed.

**H3:** *Readers unfamiliar with comic characters will be as consistent in attributing emotions to runes as readers who are familiar with comic characters:* Our findings confirmed this hypothesis. We did not find effects of familiarity with comic characters. Participants across familiarity groups were consistent in their choice, which indicates that runes may be universally understood at least in the case of droplets, spikes, spirals and twirls. It is not clear whether the NFC group had acquired familiarity with in *other* comics albums than the four sampled in this study, in which case the rune-use in these other albums was presumably similar, or whether they were not familiar with comics at all, in which case the runes may have a directly understandable, “embodied” meaning that does not have to be learned.

An important finding of our experiment is related to the color red. We found a highly significant effect of the color red on emotions in simple shapes, but not in

neutral emoticons or characters. Color psychology suggests that color and emotions are tightly coupled. In particular, color preferences are associated with whether a color elicits positive or negative feelings. While particular colors have been found to be highly preferred regardless of age, racial group, or culture (Adams and Osgood 1973; Eysenck 1941), there is some evidence that color preferences may be culturally based. For example, Choungourian (1969) found that the colors red and blue were the most preferred colors among American subjects, but were less preferred in other cultures. Saito (1996) found unique color preference tendencies between the two countries and also with respect to age, gender and geographical region within the individual country. Naz and Epps (2004) conducted a study with 98 college students with three sets of hues: primary hues (red, yellow, green, blue, purple), intermediate hues (yellow–red, green–yellow, blue–green, purple–blue and red–purple) and achromatic colors (white, gray & black). Their results suggest that green evoked mainly positive emotions such as relaxation and comfort because it reminded people of nature. The color green–yellow evoked the lowest number of positive response because it was associated with vomit and elicited the feelings of sickness and disgust. In a different study, considering colors to be described in temperature terms, such as “warm” or “cool” as related to the dominant wavelength of the color revealed that are cool colors (e.g., blue, green, purple) are generally considered to be restful and quiet, while the warm colors (e.g., red, yellow, orange) are seen as active and stimulating (Ballast 2002).

In our study, all shapes in red were found to be associated with anger. However, in the actual comic characters’ condition, we did not find any color effect, whereas when emoticons and geometric shapes were presented in red, participants indicated anger. This suggests that runes play a more important role than color in evoking emotions with characters’ faces or face-like shapes. But for simple shapes, when there were no face-like features, colors have a greater influence than runes. There could be two reasons for the color red to evoke anger in neutral emoticons and shapes. First, all participants were from India. Although, the color red in India is generally considered auspicious, in some cases it also indicates anger, strength, stimulation, dynamism, etc. A very common Hindi idiom associates the red color of a face with anger (*gusse se chehra laal hona*). So, the response was the cultural association of red with anger. Second, not only in India but in general color red is known to be associated with anger, rage, war, strength, etc. We did not find any effects for other colors. The issue why only the color red had an effect on emotions and why other colors did not have any effect on emotions needs to be further explored.

The empirical findings support the hypothesis that the presence of runes, in an isolated comic panel, indicate emotion. However, our study also suggests that particular runes cannot be associated one-on-one with particular emotions, that is,

these runes do not specifically “code” these emotions. They represent the expression of emotions only in a generic sense. As mentioned earlier, it is problematic to single out a particular emotion, as different emotions often overlap. Our findings rule out the bias of comic literacy on pictorial runes, and suggest that runes universally trigger the awareness that a character is emotionally affected. The study also suggests that runes in combination with faces or face-like features is more important in evoking emotions than colors. However, when face-like features are removed, the color influences the emotions more than runes. But this may be due to the effect of culture in interpreting runes, which needs further testing with participants from different cultures.

A few methodological issues need to be taken up in any follow-up experiments. In the first place, the labels we have chosen for various emotional states need to be reconsidered. For example, somebody who is “surprised” may also be “confused,” and somebody who is “angry” may also be “agitated,” so the emotional labels do not necessarily denote mutually exclusive states.

A second issue is our choice to present standalone pictures as stimuli in comic character condition. All the panels presented are a part of longer narratives, and the emotions that characters experience are often anticipated in preceding panels, or made clear in the context of the story as a whole. It would be useful to pursue an alternative experimental design in which not only the target panel but also one or two preceding panels are shown. But this would also mean that more *non-runic* information about the characters’ emotions (e.g., facial expressions, gestures) would be present, which might in turn affect the role of the runes in the attribution of emotion. An alternative would be to compile a set of standalone (political) cartoons, which by their very nature do not require knowledge of preceding panels.

## 5 Conclusions

Overall our studies suggests that runes cue the recognition of emotions, and thus can be said to be to some extent “coded.” Spikes and droplets were found to be associated with various generic emotions. Twirls more specifically elicited the recognition of confusion and dizziness. Moreover, it was found that runes are universally understood, especially when they are presented with faces or face-like features. The groups of participants familiar and of those not familiar with comics identify the same emotion for a particular rune. However, if stimulus material consists of simple shapes with no facial features, color has a greater impact on the identification of emotions.

Our findings provide empirical support for the role of pictorial runes in attributing emotions to comics characters, and suggest further studies in this

direction. For example, we can study the effect of the color of runes: the present study considered only black runes. We can also expand this study to include participants from different cultures, as the current study had only Indian participants. As communication is becoming increasingly visual in the current age, and emotion runes are beginning to appear outside of comics as well, for instance in advertising, we believe that understanding the role of runes in stimulating emotions will play a crucial role in designing multi-modal affective systems.

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