

# Adding Emotions to Pictures

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**Abstract.** A large number of out-of-copyright children books are available online, but are not very attractive to children due to a lack of illustrations. Automatic text illustration may enhance the reading experience of these books, but inappropriate picture coloring may convey inappropriate emotions. Since already at a very early age, children can map colors to certain emotions, we propose an approach to automatically alter picture colors according to the emotion conveyed in the text.

## 1 Introduction

Initiatives such as Google Books<sup>3</sup> and Project Gutenberg<sup>4</sup> have made a large number of out-of-copyright books freely available as e-books, including classic works of children’s literature. These e-books are currently not very appealing to children, as they are either offered in plain text or as images of scanned pages. Automatically adding pictures to such texts can make them more appealing. Existing work in automatic text illustration [5, 6, 8] focuses on factoid texts, while children texts often contain emotional passages such as the following extract from *The White Snake*, Grimm’s Fairy Tales (1812):

*The youth sat down in the garden and considered how it might be possible to perform this task, but he could think of nothing, and there he sat sorrowfully awaiting the break of day, when he should be led to death.*

We propose to post-process pictures that were identified by a text illustration algorithm according to the sentiment expressed in the text passage. Research in psychology has shown that children, even at a young age, associate certain colors with certain emotions. Based on this result, we derive a basic procedure that alters a picture’s color scheme according to the emotion that shall be conveyed. We envision the process of illustrating children’s literature as follows:

1. Determine a passage of text for illustration.
2. Run an automatic text illustration algorithm to determine a suitable picture, e.g., [5, 6, 8].

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<sup>3</sup> <http://books.google.com/>

<sup>4</sup> <http://www.gutenberg.org>

3. Perform sentiment analysis to determine the conveyed emotion, e.g., [1].
4. Alter the picture colors according to the found sentiment.

In this poster, we describe our first step in the direction of altering pictures according to emotions. The rest of the poster is organized as follows: in Sec. 2 we outline the findings of children’s ability to map colors to emotions. Then, in Sec. 3 we report our approach and results, followed by the conclusions (Sec. 4).

## 2 Children: Colors and Emotions

Color combinations are known to communicate moods and emotions [4], even at a very young age. Boyatzis et al. [2] studied the emotions children associate with colors. In the experiment, each child was given a color sample (red, blue, pink, etc.) and asked about her thoughts about the color. The sixty children (four to seven year old) in this study in general exhibited positive feelings towards bright colors and negative feelings towards dark colors. A gender gap was found with respect to dark colors: boys were more likely to have a positive feeling toward them than girls. Whether or not a color invokes a positive/negative emotion in an individual child often also depends on the child’s personal experience with that color. Zentner et al. [7] investigated the same question with even younger children (three to four year old) and reported very similar results. In a different experimental setup, Burkitt et al. [3] asked four to eleven year old children to color three figures with colors of their choice: a happy, a nasty and a neutral figure. It was found that the children used their preferred colors for the happy figure and their least preferred colors for the nasty character, implicitly assigning emotions to colors.

These studies show that children are indeed able to map colors to emotions. Based on these results, we believe that by altering the color scheme of a picture we will be able to convey different sentiments.

## 3 Adding Emotions to Simple Pictures

The existing research on assigning images to text (automatic text illustration, text-to-picture), e.g., [5, 6, 8], focuses on identifying suitable images for *factoid* sentences. We assume for the purposes of this work, that such an algorithm identified a suitable picture from a pool of available pictures. As we focus on children’s literature, we aim for simple pictures, such as those in Fig. 2(a), 2(d) and 2(g), which belong to the OpenClipart<sup>5</sup> library, our chosen picture corpus. We also need a set of color schemes that convey different emotions. To this end, we collected color schemes from Kuler<sup>6</sup>, a portal where users can create/upload/download color schemes, that were tagged with one of the following tags: *happy*, *sad* and *angry*. Examples of color schemes that we found for each

<sup>5</sup> <http://openclipart.org/>

<sup>6</sup> <http://kuler.adobe.com/>

tag are shown in Fig. 1. Each color scheme consists of four to five colors and in general, *happy* color schemes contain bright colors (as we would expect), while *angry* schemes often contain strong green and red shades. Color schemes tagged with *sad* mostly contain dull or dark colors.



**Fig. 1.** Color schemes taken from Kuler, tagged with one of three emotions.

For each of the three emotions, we retrieved fifty different color schemes. Given a picture and an emotion, the most suitable color scheme is found as follows: all color schemes available for that emotion are evaluated for their similarity to the colors of the picture: for a color scheme with  $c$  colors, the  $c$  most dominant colors in the picture are determined and each color in the color scheme is matched to the most similar color in the picture. We calculate the distance between these color pairs and then select the color scheme with the smallest distance in color to the original picture. The  $c$  dominant colors in the picture are then replaced by the colors of the color scheme.

In Fig. 2, the results of our algorithm are exemplified. Fig. 2(a), 2(d) and 2(g) are the original pictures, as they occur in our corpus, while the remaining pictures were altered by our prototype system according to the emotion in question. The results indeed show the influence of the changing color schemes.

## 4 Conclusions

In this work, we have presented an idea and a first prototype of how to add emotions to simple pictures, that can be used in the automatic illustration of children’s literature. We have devised a basic algorithm that relies on available color schemes (tagged by humans according to the emotion they express) to change the conveyed emotion of a picture. A natural next step for our work is to evaluate this algorithm in a user study with children; we are going to address the following questions: (i) do children recognize the different emotions that we aim to convey in our automatically altered pictures, and, (ii) are children interested in having pictures accompanying text that convey emotions?

A limitation of the current approach is the small size of the color schemes ( $\approx 5$  colors), which limits the usefulness of the approach to pictures with few dominant colors. In the future, we plan to combine different color schemes to have a larger color base as well as to rely on hue and saturation to change the emotional content of pictures.



**Fig. 2.** The first column shows the original pictures, while the remaining pictures are the output of our color-altering algorithm.

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