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# A Smart Phone Tool to Create Photo Collages

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**Abstract**

This paper presents the application PhotoPieces, a software tool which allows people to create photo collages on the fly in a camera-equipped handheld device using predefined or custom templates. Users can also create their own templates on-the-fly taking a photo and transforming it into a multi-region image template. A preliminary study with different types of users has been conducted to evaluate its value as a creative tool.

*Keywords*: Collage; photography; smart phone; creativity

## 1. Introduction

New digital technologies can be used for reducing required technical level to perform certain creative activities or to increase the quality of the creations. New interaction technologies encourage the creation of digital counterparts derived from traditional artistic techniques. SandCanvas [1] tries to emulate sand painting in a multi-touch table. Glowdoodle [2] overlays on the captured video stream the brightest parts of each frame, creating an effect similar to exposing cellulose film with a distant directional light.

A collage is an artistic composition made by assembling different parts. They are often composed of pieces from other works of art, ribbons, bits of colored paper or newspaper clippings glued on a canvas. This technique is formally established in modern art and used by both renowned artists (e.g. Pablo Picasso and Marcel Duchamp) and amateurs. Lately different photo collages creation tools have been implemented using digital technologies: f.e. Collage Machine [3] allows creating collages with images fetched automatically from websites. Stained glass photo collages are created from a set of photos laid out by a placement algorithm [4].

Nowadays mobile devices come equipped with a camera and have great computing power. Cameras in smart mobiles have been used in several applications: as sensor of colors, movement or barcodes that signals some input; to augment reality displaying objects in the real world or to take photos which become items in

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augmented reality games [5]. A few applications modify photographs taken on mobile devices using different types of filters or image processing algorithms [6] producing original images with artistic results. Up to our knowledge apps for creating photo collages in smart phones, are only used to create photo-stories with basic squared templates as in the Diptic App.

We propose to take advantage of the ubiquity and processing capabilities of these camera-equipped devices in order to facilitate the creation of photo collages using pictures taken with the device itself while doing the activity. We designed and developed a mobile application to create collages whereby a template segmented into different regions is presented to the user; the collage must be completed by filling each of these regions that compose the template with a picture taken at the time. The users have also the possibility of making their own templates at any time taking photos and applying to them image processing functions to create an image with different regions. We conducted a preliminary study with two different groups of users, computers science students and art workshop participants, to determine the creativity support of the tool using the CSI survey [7].

## 2. PhotoPieces

PhotoPieces has been designed to permit creating photo collages using mobile devices endowed with a camera. It has two novel features: support "on the fly" collage creation and user made templates. PhotoPieces also follows many of the design principles for creative tools reported in [8]: support exploration, low barriers, support open interchange, make it as simple as possible, invent things that you would want to use yourself, iterating and evaluation of the tool.

Unlike other photo composition applications, PhotoPieces allows taking pictures and creating collages while on the move. Creators can experience context and create at the same time. As a result we expect that creations will have distinctive nuances. Furthermore the possibility of letting the users to create their own templates adds a level of sophistication to the creative process and in turn, enhances the creative possibilities of the tool. We expect that users will make arrangements with physical objects such as post-it notes, in order to take a picture and transforming it into a template.

We have implemented and released for free an application for the iOS platform. The implemented app allows the user to choose the desired template from a predefined set of templates or from previously created ones. A template is composed of different regions, each region will be sequentially filled with a photograph. This simple creative process is depicted in Fig 1.a The user can take photos in different locations and the resulting photo collage can be saved and shared.
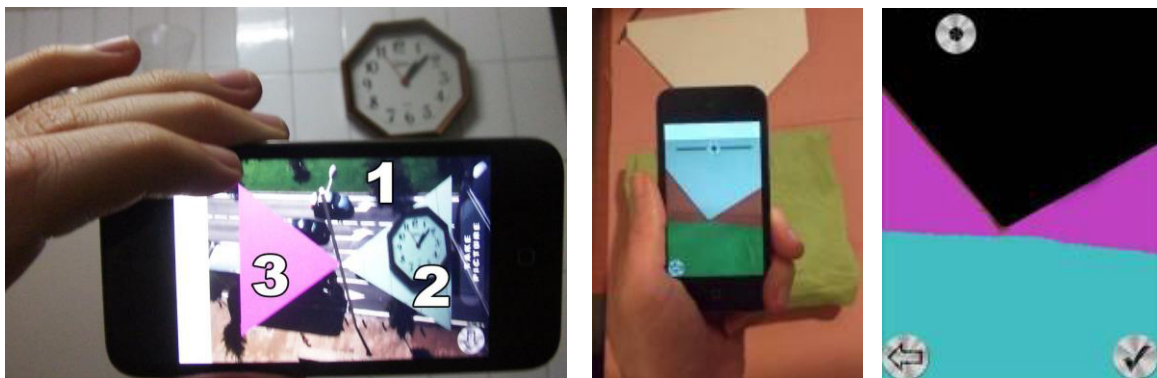


Fig. 1. (a) an ongoing PhotoPieces creation: the user is taking a picture to fill the area 2, area 1 contains a fragment of a photograph taken earlier and zone 3 will be filled with a fragments to take in a later time; (b) a picture taken with the camera: the upper slider will choose the sensitivity level with which the image will be segmented; (c) resulting template with one solid color per detected region.

PhotoPieces allows creating templates on the fly by simply taking a picture and transforming it with an image processing algorithm into another image with a limited number of regions (Fig 1.b and 1.c). Templates are created based on an original image taken with the camera or previously stored in memory. An image processing function segments the original image with one solid color per detected region. The image processing algorithms is a modification of an efficient flood fill algorithm [9] using the sum of squares of differences between the color channels as a measure of inequality between pixels.

## 3. Evaluation

Two groups of users tested PhotoPieces. The first group was composed of 6 students from a master degree in Computer Science (age M=27), the experience was conducted on the university campus. The second group consisted of 10 teenagers (age M=15), participants of an art workshop held in a museum of contemporary art. The activity was performed individually in group 1 whereas in group 2 it was done in pairs. In the first phase, it was explained to the users how to use the tool for filling a predefined template, 10 minutes were assigned to make as many creations as they wish. In the second phase it was shown how to create your own template and another 10 minutes were allotted to produce and fill one. Afterwards they were asked to fill in a specific form to evaluate creative tools, the CSI questionnaire [7]. A small group of participants underwent an interview to elaborate on how their creative process went off during the use of the tool.

Photo collages in Fig 2 left and center were taken by computer science participants and art workshop participants. Users from the first group created an average of 2.33 collages, whereas the second group of participants created an average of 1.5 collages. Fig 2.right shows two templates created at each group. Quantitative results for CSI indicators were (W weight from 1 to 5 refers to the importance that users gave to a particular aspect of the creative process; V from 1 to 10 value of its score): Exploration W=2.33 and V=9.33, Collaboration W=0.50 and V=5.50, Expressiveness W=3.83 and V=8.75, Enjoyment W=4.16 and V=9.08, Immersion W=1.50 and V=8.75, Results worth effort W=2.66 and V=8.83. Using the formula in [7] PhotoPieces gets a CSI of 88.39, the index ranges from 0 to 100. This value is higher than other applications: symShow: 72.94 and iPhoto: 62.81 [7], however since those applications are not similar and the CSI is not a standard metric yet, this result is only a mere indicator which suggest that PhotoPieces is a useful creative tool.

All participants were satisfied with their creations, as shown by the indicator "Results worth effort" in the questionnaire, and as was communicated in the interviews. Collages made with the application have a distinguishable style from traditional ones that could be attributed to both the "on the fly collage creation" and "user-made templates" characteristics of Photopieces.

Participants commented on the final interview that their creations were driven by the "on the fly" feature of the tool following behaviors like: an user starts taking any picture for the first piece of the template and then moves and look around for other pieces that match the first picture.

Creating custom templates produced an unexpected result, because it adds a new level of creativity in choosing the means to make them, the participants spontaneously used different methods: logos, organic shapes (Fig 2.right top), signals (Fig 2.right bottom), or post-it notes. All participants commented on the final interview that this feature was very novel and interesting. An user commented "to create my collage (the left botton collage in Fig 2), I imagined in the template a face, then started looking for elements that matched a mouth, eyes and two half faces". Templates act as seeds that inspire but at the same time allow high degree of freedom when taking images. Many participants made more than one template when they were only asked to create one.

Some users suggested the integration of the application with social networks to share content. Additionally PhotoPieces could be created collaboratively in an "exquisite corpse" manner as surrealists and other artists have done.
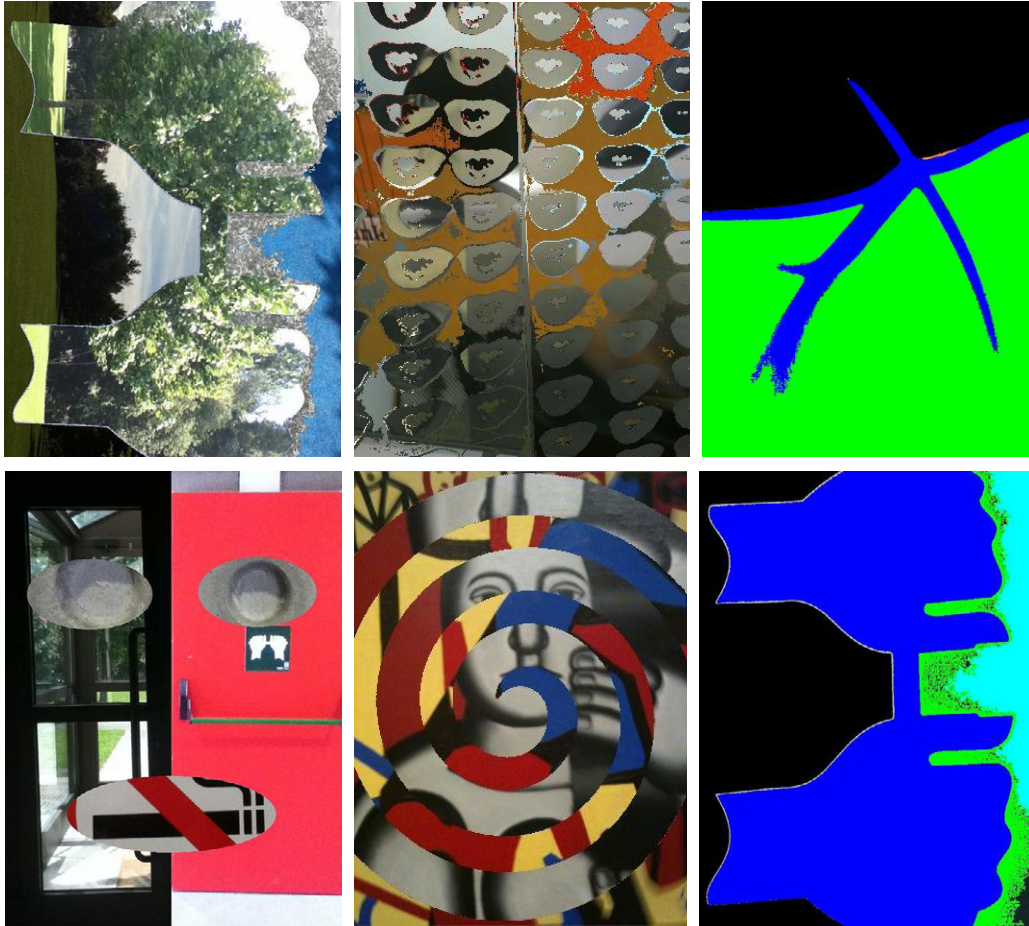
Fig. 2. (left) computer science students' creations; (center) art workshop participants' creations; (right) custom made templates.

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