Color Mixer: A New Palette

HCI PROJECT REPORT

BY GROUP 4

目录

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Project Drivers

The Purpose of the Project

1. Background

An important part of the digital painting process that has not received enough research attention is the design of the color picker. Most software relies on old interface concepts built around selecting RGB or HSV slider values directly or choosing a color from a palette of swatches. This is unfortunate because choosing and composing colors is a critical part of any painting process.

Our Color Mixer is designed to support the different tasks artists use paint palettes for, while employing an easy interaction mechanism that allows rapid exploration and creative inspiration.

Color Mixer consists of a number of color blobs that blend with nearby blobs within some distance threshold, allowing the user to quickly select mixed colors along the resulting gradients. Blobs can easily be moved or recolored to create new color combinations and new gradients, while an infinite history ensures no previous combination is ever lost. Multiple palettes can be created and accessed using history to represent different parts of the painting.

2. Goals of the Project

The primary goal of Color Mixer is to support the color selection needs of digital painters. The secondary goal is to make artists more creative, which we support in two ways. The non-destructive editing and spatial arrangement capabilities make it easy for artists to experiment with different harmonies and gradients, which lets them evaluate different palettes more rapidly and effectively.

Stakeholders

1. The Client

① School of art
② Company of art industry
③ Independent artist and designer

2. The Customer

① Digital Artist
② Digital Designer
③ Student of art and design

3. Other Stakeholders

① Designer of digital painting media
② Developer of digital painting media
③ Company of digital painting media

Users of the Product

1. Hands-On Users

User Description	Role	Experience
Company of digital art industry that want to improve capacity	Client	Have used digital painting media before
School of art that want to improve quality of education	Client	Have used digital painting media before
Digital artist and designer	Customer	Have used digital painting media before
Student of art	Customer	Don't have enough experience of digital painting media
Traditional artist and designer who want to try digital media		Have experience of painting Don't have enough experience of digital painting media

2. Priorities Assigned to Users

①Key users: Those who know well about digital painting media, always work with digital painting media, and want a more powerful digital Palette

②Secondary users: Those who need to use digital painting media as a necessary tool for working or studying
③Unimportant users: Those who use digital painting media, while digital painting media is not a necessary tool for them

3. User Participation

①Data records users' performance when they interact with the product
②Feedback from users about how they use our interface to work with color
③Suggestions about usability improvements for our prototype

4. Maintenance Users and Service Technicians

①According to feedback from users, adjust the product to improve its usability
①According to requirements from users, develop more features of the product

Project Constraints

Mandated Constraints

1. Solution Constraint

① Description

The product shall use HTML and JS to communicate with Photoshop. The customer will operate with the mouse.

② Rationale

The Photoshop interface needs the use of HTML and CSS. Mouse event needs the use of JS.

③ Fit criterion

All operations can be completed with the mouse. The customer only needs to operate through the interface.

2. Implementation Environment

The product needs to be installed on Photoshop with version number ranging from CC to CC 2018. It also can be installed on both Windows and Mac.
The product contains an HTML file, a CSS file and a JS file. Users need to put the files under the corresponding folder and open the Photoshop. Thus, they can see our product. The HTML file determines the product's structure and content. The CSS file sets the product's presentation style. The JS file controls the product's behavior. They together make up our product.

3. Collaborative Applications

As we all know, there are many versions of Photoshop. Each version has a different

extension plug-in interface. Our product is only applicable to those with version number ranging from Photoshop CC to CC 2018.
Because the user operations are performed with the mouse, mouse events will limit the functional diversity of the product.

4. Off-the-Shelf Software

We only use the Photoshop as the graphical interface of the product. Besides, the first time we download and install the Photoshop, there is a 30-day trial period. So, our use of Photoshop is legal.

5. Anticipated Workplace Environment

In our expectation, the user is a painter. He or she may use the product at work or at home, may use the product to draw or make posters. In these cases, our products are already competent enough. Moreover, the product is relatively small, it will not affect the user when he or she is using the computer.

6. Schedule Constraints

In the summer vacation, students will start to read comics and watch animations, etc. This require the painters to draw part of the manuscript in advance. Therefore, this product is needed. As a result, we need to complete the product before July. Now we have completed most of the functions.

7. Budget Constraints

Because the product is based on Photoshop and the information we used is open source, there is no budget in our product.

Naming Conventions and Definitions

1. Definitions of Terms

Color mixer: The palette in our product.
Palette: The palette in the Photoshop.
Layers: Like staked, transparent sheets of glass on which you can create images.
Canvas: Images outside the scope of the canvas are not displayed. The portions of the canvas beyond the size of the image are displayed as transparent areas.
Foreground color: The color used to paint, fill, and stroke selections. The default foreground color is black.
Background color: The color used to generate gradient fills and fill in areas where the image is erased. The default background color is white.
CEP: Common Extensibility Platform. A universal development standard for Photoshop extension.

2. Data Dictionary

In our product, we do not have a data dictionary. All data are stored and read directly.

Relevant Facts and Assumptions

1. Facts

Because of the JS interface, brush may have problems if it has transparency.
Every time the user closes the Photoshop and opens it again, the colors stored will be cleared.

2. Assumptions

If the user uses too many colors, the interface may not be able to fit these blobs.

User Survey

User Analysis

1. General Characteristics

We selected many people who meet the following requirements and handed out our questionnaire to them.
① Digital Painting Experience: They have used computer or smartphone to paint for some time and know about the use of traditional digital palette.
② Use Photoshop CC: They are 15-40 years old, since we think those people have the maximum probability of using Adobe Photoshop CC or more recent versions.
③ Hand Painting Experience: They have drawn a lot of pictures on paper in their life, or will consider drawing pictures on paper for fun.
④ Possibility of Painting in Future: Some of them may work as a painter, designer or do other jobs related to painting now or in the future. Some of them just won't give up painting in near future.

2. Personal Characteristics

User ID	Gender	Age	Description
01	Female	21	Regards painting as a hobby.
02	Female	21	Likes Painting and is good at art.
03	Female	26	Works as a designer now.
04	Male	22	Paint sometimes, not often.
05	Male	25	Use Photoshop just for photo processing.

Questionnaire Design

① Which media do you prefer for painting?

a) Physical
b) Digital
c) About the same

② Which kind of palette is more convenient in your opinion?

a) Physical
b) Digital
c) About the same

③ When painting with physical media, would you create color combinations by tempering colors with others that already occur in the painting?

a) Never
b) Sometimes
c) Often
d) Always

④ When painting with digital media, would you accessing historical colors?

a) Never
b) Sometimes
c) Often
d) Always

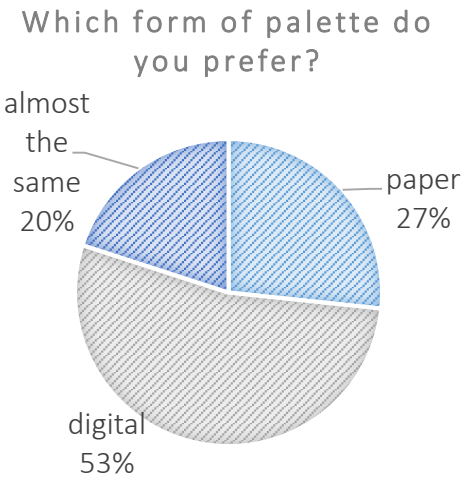
⑤ Which description of color do you prefer?

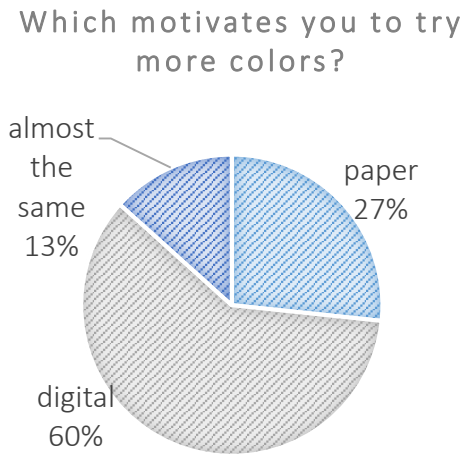
a) Color is more about emotional response
b) Color is more about numeric precision
c) About the same

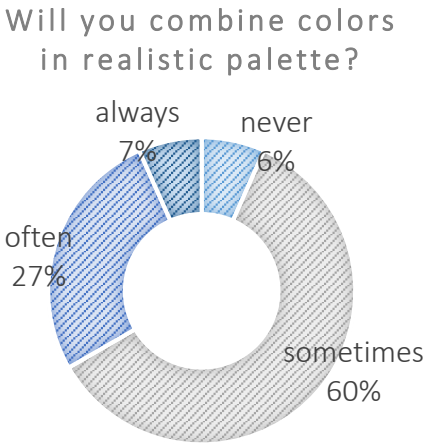
⑥ Which feature of digital palette following do you most expect?

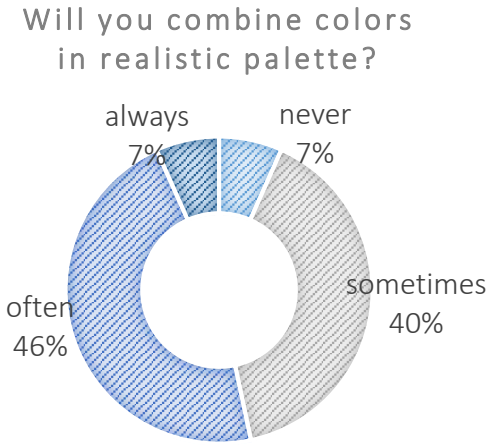
a) Create different color combinations from given colors
b) Access to historical colors
c) Access to history of mixing colors
d) Others_____

Result









Discuss

1. Potential Tasks

In our products, the following functions may be required.

① Color Blending: Provides a series of intermediate blend colors for the given color. The user can intuitively see the blended colors and choose the color they want for painting. Also, the user can adjust the distance between the blobs to get different mixed colors.

② Change Colors in Picture: Change the color tone of the layer. Users can try different color combinations. First, the user should create at least one layer when drawing. By changing the color of a layer, we can get a completely different picture.

③ List All Used Colors: List the colors that have been used. When it is necessary to use the previous color, the user can select the color directly from the list without having to

reselect the color.

④ History Of The Palette Process: Demonstrate the process of user coloring and history can be deleted when the user does not need it.

⑤ Change The Color Of Blob: We use the blob to take color. Its color can be changed by the foreground and background colors.

2. Selected Tasks

① Task 1: Provides a series of intermediate blend colors for the given color.

Reason: This is the main function of our products.

Most software relies on old interface concepts built around selecting RGB or HSV slider values directly or choosing a color from a palette or swatches. This is unfortunate because choosing and composing colors is a critical part of any painting process. We find that artists interact with their palette several times a minute, and many of the interactions are not well-supported by digital color pickers.

Some software mimics a real paint palette to allow mixing of colors, but such a literal adaptation of the physical interface loses many of the advantages of digital tools such as non-destructive editing.

Though this function is designed to support the different tasks artists use paint palettes for, while employing an easy interaction mechanism that allows rapid exploration and creative inspiration. This function consists of a number of color blobs that blend with nearby blobs within some distance threshold, allowing the user to quickly be moved or recolored to create new color combinations and new gradients. We hope this function can directly support the color selection needs of digital painters.

On average, users interacted with the physical palette 3.2 times per minute and with the digital color picker 1.7 times per minute, with interaction frequency fluctuating, but remaining consistently high throughout both tasks. In our user survey, only six users think this function is not necessary.

② Task 2: Change the color tone of the layer, users can try different color combinations.

Reason: This is the main function of our products.

Because of the infinite history tracking, after a color from the palette has been used to paint part of the canvas, that palette can be retrieved, and the palette blob's color can be changed, causing the painting to be re-colored accordingly. This allows the artist to continue exploring his or her chosen color gamut even after spending a considerable time painting.

We hope this function can make artists more creative, which we support in two ways. First, the non-destructive editing and spatial arrangement capabilities make it easy for artists to experiment with different harmonies and gradients, which lets them evaluate different palettes more rapidly and effectively. Second, following research indicating that positive emotion boosts creativity.

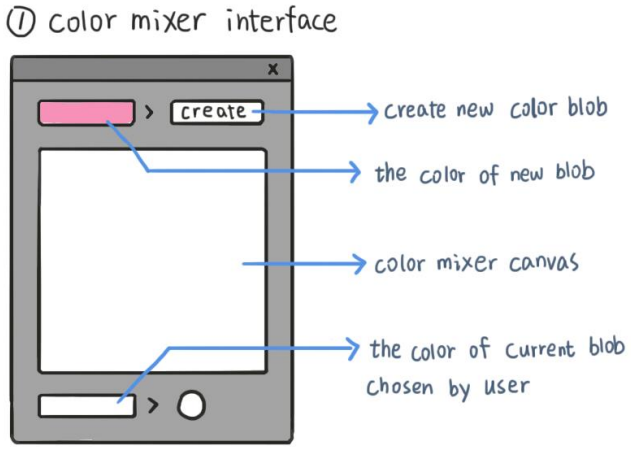
③ Task 3: Change the color of the blob.

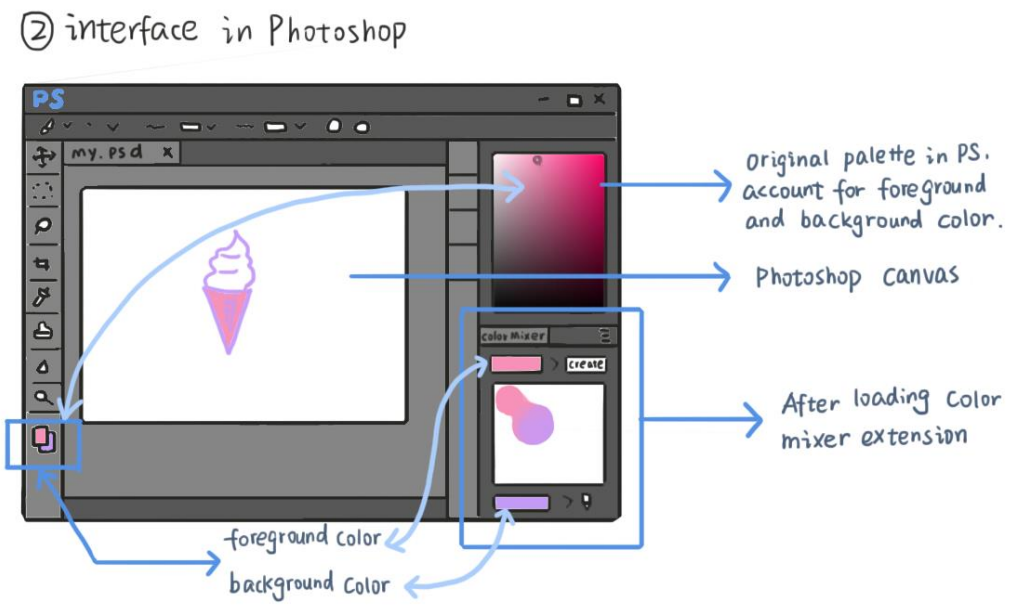
Reason: A traditional palette is a set of blobs of color that blend together to create gradients and gamut. In the traditional palette, we cannot delete a specified blob, nor can we change the color of the blob.
But in the digital palette, we think this function can be implemented. Blobs should easily be recolored to create new color combinations and new gradients. It will be more convenient when painting. And the artists can have more choices when they are drawing. Also, this function can make artists more creative.

In our user survey, only 5 people think these two functions are necessary, which is listing the colors that have been used and the history of the palette process. Therefore, we do not include them in the function we selected.

Prototype design

Overall Idea





Scenarios

1. The First Scenario

① Description

One day, a girl, we call her Alice, downloads and opens this Photoshop extension package. Curiosity drives her to try this product. It is the first time that she has used Photoshop extension, so the question how to put it in Adobe Photoshop puzzles her. So Alice opens the *readme* and follows the instruction. It's not difficult, and soon she successfully configures this little tool. She also learns how to use it with mouse and keyboard from this *readme*.

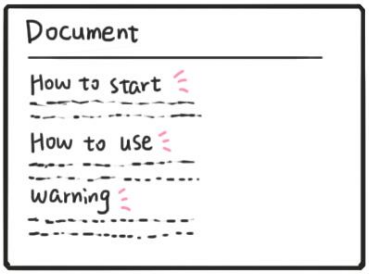
She immediately begins to paint a flower in Photoshop. First, she uses the original palette in Photoshop to pick the color she wants, for instance, yellow. Then she clicks the *create* button, and soon a solid yellow blob appears in the upper left corner of the canvas in this color mixer extension. Next, she creates pink, blue color in the same way, and drag those blobs, with right mouse button, to proper position.

Alice used to draw every color she needed on an individual layer of her picture, in order to record each color that she would like to brush. Sometimes she had to mix them manually to obtain a mediate color.

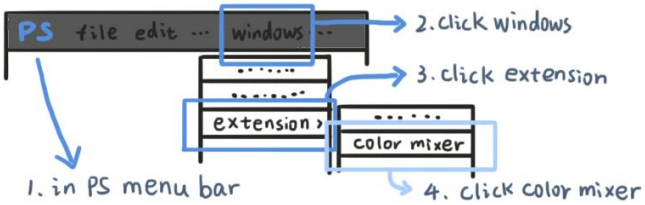
But now, with the new tool, Alice easily maintains three main colors and a series of gradient colors. She picks a purple color between pink and blue on the color mixer and draws a purple stroke on the Photoshop canvas.

② Illustration

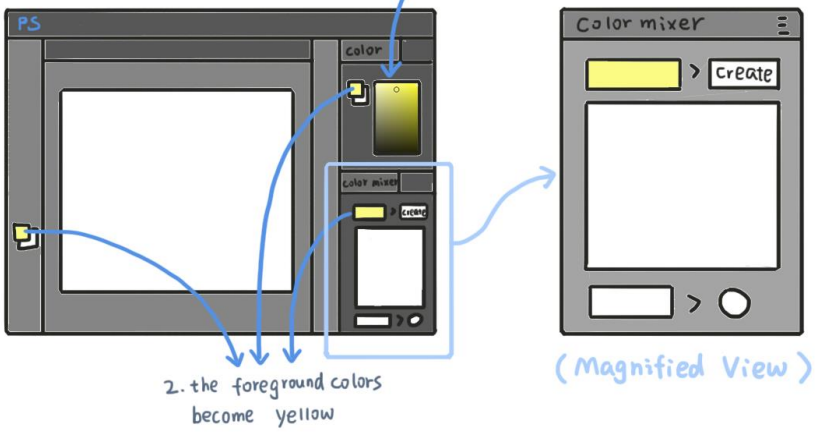
① Alice consults document



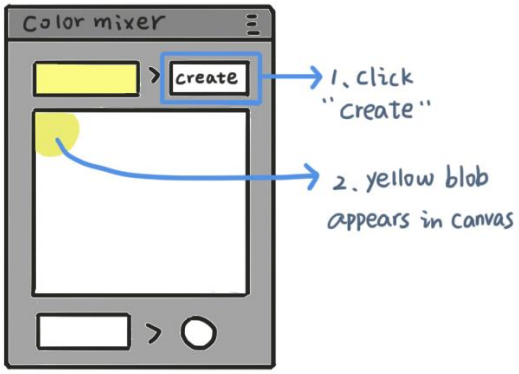
② Alice sets up color mixer



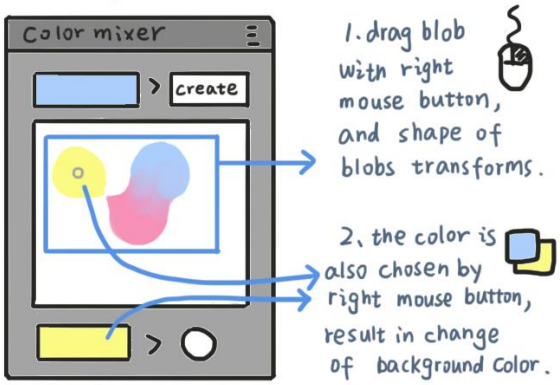
③ Alice begins to use

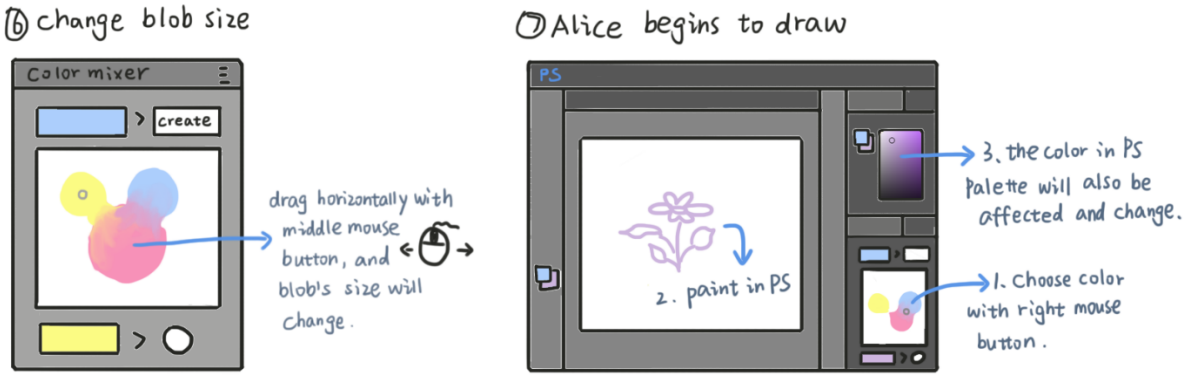


④ Create new blob



⑤ Change position of blob





2. The Second Scenario

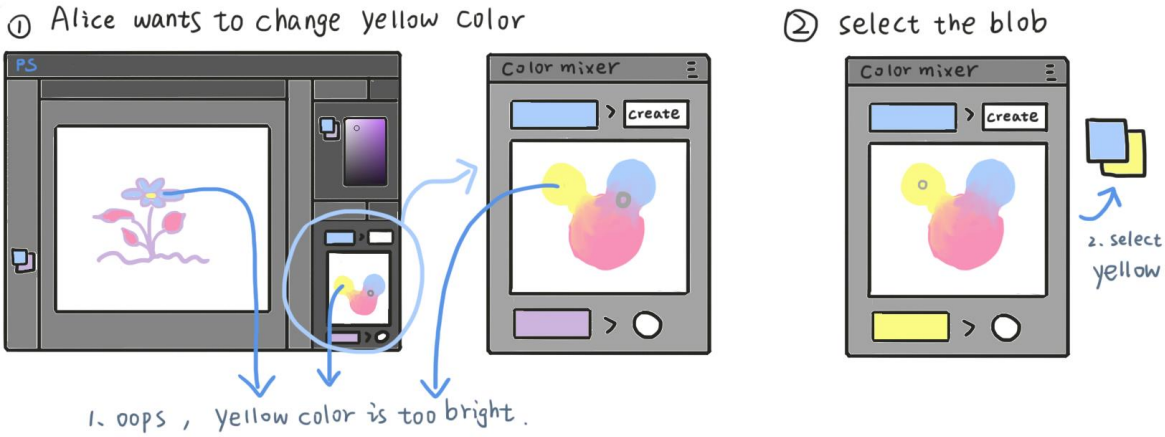
① Description

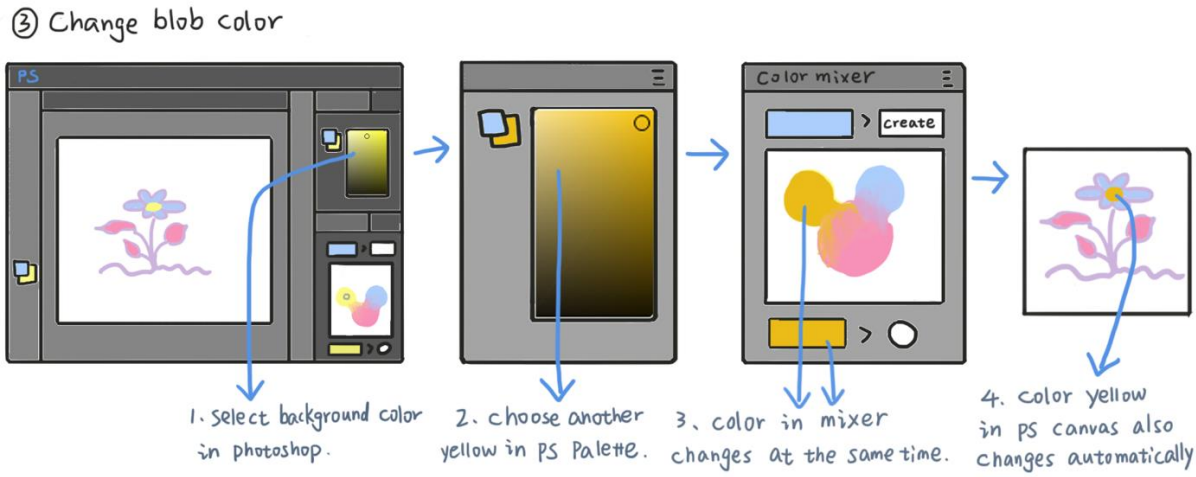
This time, our Alice, finishes drawing her flower. Unfortunately, she realizes that the yellow color is much too bright for her flower.

In the past, Alice had to erase this color and redraw with another yellow brush or select the unsatisfactory area with yellow color so that she could adjust the hue value, though it was troublesome since yellow color usually already had spread all over the picture. Moreover, there were some yellow areas blended with other color, thus being no longer the same pure yellow as Alice's first yellow stroke.

But now, she is able to turn to the color mixer extension for help. Alice selects the yellow blob, and then changes the color in Photoshop's native palette. As a result, the yellow blob in color mixer starts to change its color, and meanwhile, the yellow color in Alice's picture also changes. Alice feels OK eventually. She saves her picture and closes the color mixer with relief.

② Illustration





Cognitive Walkthrough

1. Photoshop Version Conflict

① Scene

When Alice opens the color mixer package, sets up this extension, she finds it doesn't work, or works awkwardly because the version of her Photoshop is CS3, which is too old for Photoshop's extension to exert.

② Solution

We will write down a detailed document which helps user and displays all precautions, including suitable versions of Photoshop. We think it embarrassing to support all versions of Photoshop, since there are too many versions and coding method of Adobe extension has been continuously developed. On the other hand, our color mixer extension will be well compatible with Photoshop released from 2015 to 2018, which covers most of the recent versions that are commonly used nowadays.

2. Confusing Picture Layers

① Scene

We plan to achieve the function of our color mixer by adding a picture layer filled with the corresponding color in the user's Photoshop document, so that we can operate every color individually. But this raises a question: Every time when Alice creates a color blob, our color mixer will add layers to Alice's Photoshop document. And Alice herself may add her own layers in the meantime. How does Alice know which layer is created by herself, and which layer is created by the color mixer?

② Solution

We can give the layers created by the color mixer a special name, in order to prevent the user from being confused about all kinds of layers. For example, we may name the

color mixer's layer with a prefix such as CM, the abbreviation of color mixer.

3. Visibility of Color Picker

① Scene

Alice wants to pick a color in the color mixer. When she clicks the color mixer's canvas with the right mouse button, the canvas will render a small grey circle marking where Alice's mouse has clicked, indicating that the color in circle is currently in use. However, what if Alice wants to pick a grey color? The grey surroundings will conceal that grey circle. And Alice feels a little annoyed to lose track of her color marking stuff.

② Solution

The marking circle should change its color when staying on a piece with similar color. So, the circle is usually black, whereas it will become white while the user is picking a dark color.

Final Product

Result

(See the file *ColorMixerDemo.mp4* in the report folder and the source code for detail)

Documentation

1. Offline

(See the file *Document.pdf* in the source code folder for detail)

2. Online:

https://github.com/Birdy-C/HCI_ColorMixer/tree/master/Document