Smart Scribbles: User Study Report

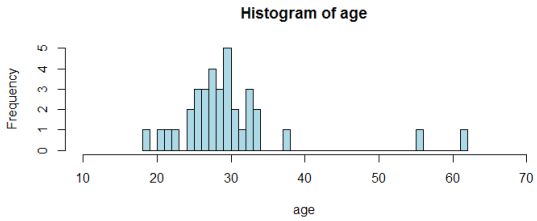

Figure 1: *Age histogram for the 35 participants of our user study.*

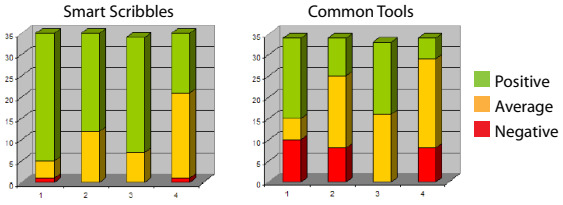

Figure 2: *Tools Evaluation. These plots show the questions and answers given after testing the tools in the first phase of the study. The numbers in the horizontal axis refers to the following questions:*
1. Did you like the interaction metaphor? (No, don't know, yes)
2. How good was this tool, or set of tools, for coloring complex drawings? (Badly suited, fair but not great, seems good)
3. Given enough time to practice, do you feel this is a tool, or set of tools, you could become efficient with? (no, maybe with effort, yes)
4. If yes, how long do you think it would take? (long time, some time, little time)

1. Introduction

This document is a report of a user study conducted during the evaluation of the **Smart Scribbles** method. It is intended as complement to the technical paper.

2. User Study Report

In order to test the efficiency and ease of use of our method, we conducted a user study comparing Smart Scribbles to our implementation of several commonly-used selection tools, namely point, box, and lasso (these tools are typically included in professional vector graphics software such as Adobe Illustrator or Inkscape). As shown in Fig. 1, 35 participants took part in our user study (8 women and 27 men with ages ranging from 18 to 62). There were 5 artists, 9 hobbyists, and 21 people without drawing experience. None of them used Smart Scribbles before therefore all can be considered as novel users. Five had no experience with Adobe Illustrator or Inkscape, 14 had little experience, 15 were normal users, and 1 was an expert.

2.1. Learning Phase

The study began with a short tutorial introducing the selection tools. Here, users were allowed to test all four selection tools on a variety of simple drawings. There were examples to illustrate that there is no prescribed set of gestures for Smart Scribbles, the only recommendation was to try to roughly follow the shape and try to be as close as possible to the desired object. After this learning phase, the users were asked about their experience. The questions and answers are shown in Fig. 2.

2.2. Comparison Phase

The participants were next shown pairs of identical drawings, one of which had already been labeled, while the other had not. Their task was to reproduce the stroke selection for the unlabeled drawing. In order to complete this task, the participants first used our Smart Scribbles (with parameters set according to Table 1) and then the common tools (point/box/lasso). This process was repeated with four different sets of drawings, for a total of eight labellings per participant. The order in which the eight scenarios were presented was random.

Participants were randomly divided into two groups. First initial group of 17 people worked on a selection of 4 simple drawings (skull, house, combo, and snake, see Fig. 3) while second group (18 people) had 2 simple (skull and house) and 2 complex drawings (abstract and characters).

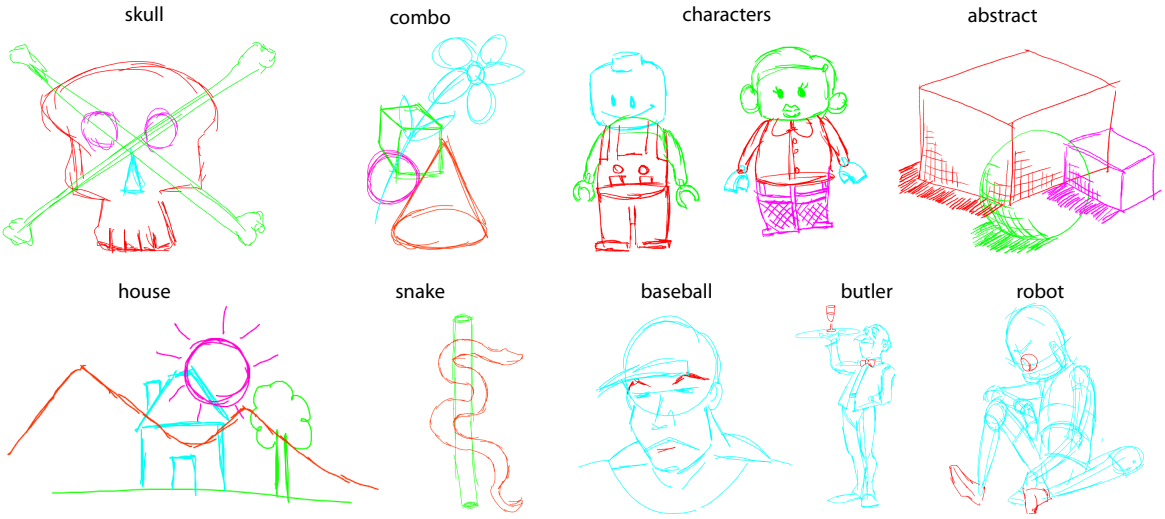

Figure 3: *Drawings and labeling used in the user study.*

Parameter	Value	Unit
λ	4	
$\sigma_{prox\ smooth}$	100	px
$\sigma_{dir\ smooth}$	0.5	
$\sigma_{time\ smooth}$	1000	ms
$\sigma_{curv\ smooth}$	0.1	
$\sigma_{prox\ data}$	[10 ; 90]	px
$\sigma_{dir\ data}$	0.1	
$\sigma_{curv\ data}$	0.25	
B	0.0001	
artboard width	1200	px
artboard heigth	1200	px

Table 1: *This table shows the Smart Scribbles parameters used for the user study. Refer to the actual paper for their meaning.*

drawing	speed-up	$t(df)$	p-value
combo	1.23x	-1.8798	0.07847
snake	1.53x	-2.4807	0.02461
skull	1.83x	-8.3931	0.00000
house	1.85x	-5.2488	0.00001
abstract	2.36x	-5.5759	0.00003
characters	1.65x	-3.8896	0.00118

Table 2: *Median speed-ups and results of paired t-tests comparing times spent on labeling different drawings using Smart Scribbles and common tools.*

During the performance gain test our system measured interaction time and accuracy of the final labeling. Additionally, for the second group we measured mouse mileage. Mouse and keyboard were used to perform interactions with the system. There was a possibility to invoke undo/redo, zoom in/out and center viewpoint to the current position of the mouse cursor. In addition to that all participants were asked to respond to questions of which aim was to assess their subjective feeling about how these tools are suitable for the task.

Overall distributions of times and mouse mileage measured during the experiment are depicted in Fig. 4. There is a notable performance gain when comparing Smart Scribbles to common tools ranging from 1.23x to 2.36x (median speed-up). Paired t-tests (see Table 2) have indicated that this gain is significant for 4 out of 6 drawings considering tight confidence level of 99.5%. Except couple of outliers the accuracy of labelling was typically close to 100% which indicates most of the participants were careful and tried to fulfill the task properly. Since the parameters of Smart Scribbles were fixed during the test we can also claim that a wide variety of users is able to produce target labeling within notably lower time as compared to common tools without necessity of tedious personalized parameter tuning.

The qualitative results of this phase are shown in Fig. 5.

2.3. Locality Control Phase

When we asked participants whether they like interaction metaphor of Smart Scribbles 30 responded yes, 4 did not know, and 1 said no. For common tools answers were: 19 yes, 5 did not know, and 10 said no. Moreover, 23 participant were convinced that Smart Scribbles are good tool for segmenting drawings with complex depth contrary to only 9 who preferred common tools. Based on these two questions a paired Wilcoxon signed rank test indicated the preference of Smart Scribbles over the common tools is significant with

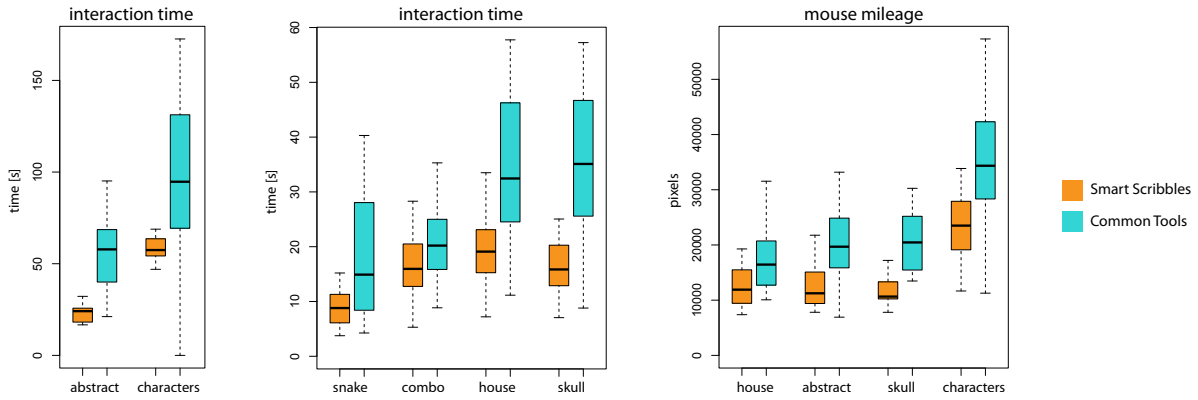

Figure 4: *Interaction times and mouse mileage of participants for different drawings using Smart Scribbles (orange) and common tools (blue).*

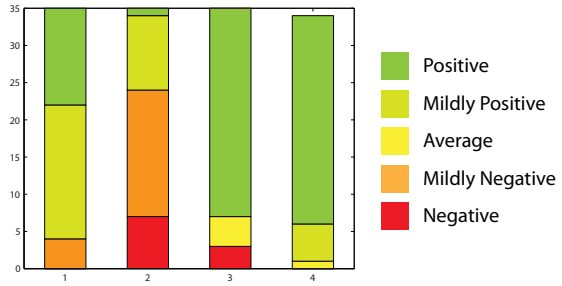

Figure 5: *Tools Comparison. This plot shows the questions and answers given after the performance tests in the second phase of the study. The numbers in the horizontal axis refers to the following questions:*
1. Did the scribbles let you solve the tasks efficiently? (No, sometimes, mostly, definitely)
2. Did the common tools let you solve the task efficiently? (No, sometimes, mostly, definitely)
3. Which tool did you prefer? (Common tools, no preference, scribbles)
4. Should scribbles be added to programs like illustrator, would it help people with their work? (No, I don't know, possibly, likely)

the confidence level of 99.5% ($V = 102$, $p = 0.00159$ and $V = 363$, $p = 0.00083$ respectively).

In addition to the performance improvement tests and tool preferences we also let the participants to experiment with continuous locality control (speed driven) and binary switching between local and global influence of Smart Scribbles. They were asked to reproduce labeling of details in three different drawings (baseball, butler, and robot, see Fig. 3). In the first round participants controlled locality using mouse speed (linear relationship between speed and locality was used as proposed in [**?**]). In the second round shift key was used to switch between two different modes (global as a default and local with key pressed).

After the test partecipants were asked four questions, as shown in Fig. 6. First, they were asked whether they noticed the effect of the mouse speed on continuous locality control. Most participants (28) noticed the effect and only 7 were not sure. Then we asked whether they prefer continuous control using mouse speed or binary control with shift key. A majority (31) was for binary switching, only 2 people preferred speed-based control, and 2 have no preference. One of the reasons for this result might be the fact that users typically do not like to have some kind of time limitation when interacting with the computer. This observation is in line with another question we asked, i.e., whether they think speed is a good way to instruct the computer on what you want they do. Only 6 said yes, 27 participants answered: *No, don't want to be slow*, and 2 *No, it's hard to control*.

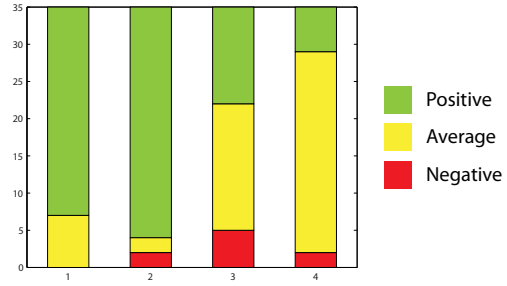

Figure 6: *Tools Comparison. This plot shows the questions and answers given after the performance tests in the second phase of the study. The numbers in the horizontal axis refers to the following questions:*
1. Have you noticed any difference between local and normal scribbles? (No, maybe, yes)
2. Did you prefer using speed-based or SHIFT-based scribbles? (Speed-based, no preference, Shift-based)
3. Given enough time to practice, do you think you could control speed well? (No, possible, likely)
4. Do you think using speed is a good way to instruct the computer on what you want to do? (No, hard to control, No, I don't want to be slow, yes)