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Enhanced Visualization of Detected 3D Geometric Differences

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1. Introduction

This document contains a complete description of the three user studies conducted and all the data collected during these three sessions. After a detailed description of the followed protocol and the aggregated results, we report the data collected in four parts:

First Part: In the first part, we show the data of the first and second user study aggregated *for each scene*. In particular, we show the input viewpoint data used during the test (S_0, S_1 and the relative change maps), the tables with the results of the two sessions aggregated by visualization techniques, and the outputs of the first session. We show the choices of each subject on the tiles' grid using the following color codes: red=change, blue=no-change, transparent=no-answer.

Second part: We show the data of the first user study aggregated *for each user* with the relative statistics.

Third part: In the third part, we show the data of the second user study aggregated *for each user* with the average score given by the user for each technique.

Fourth part: We show the input data of the final user study aggregated *for each scene*. In particular, we show the input viewpoint data used during the test (S_0, S_1) with the relative classification map of the change areas that should be marked, the aggregated number of right marks versus the elapsed time, and the inputs entered by the subjects for the two tested methods CHANGEMAP and SMOOTHSTEP1.

2. First Session - Objective evaluation

To evaluate the effectiveness of the approach we measure how well the subjects are able to correctly identify *change/no-change* areas in some scenes by tagging squares of a superimposed grid. A technique from the four under investigation is chosen randomly and used for each user/scene combination. The subject sees an automatic transition from S_0 to S_1 and back to S_0. The animation is performed in 5 seconds subdivided as: 250ms on S_0, 2000ms for the transition from S_0 to S_1, 500ms on S_1, 2000ms for the transition back from S_1 to S_0 and 250ms on S_0. This animation is repeated three times. The transition duration is sufficient to activate the visual working memory [War04] and, at the same time, such that the velocity of the visual transitions of the changes can capture the visual attention of the users (i.e. the change blindness phenomenon). The number of repetition permits the subject to better localize the changes. Three repetitions allow making the total session duration reasonable. In fact, a session too long (e.g. > 20 minutes) can reduce the general attention of the subject. At the end of the third animation, the subject can indicate the areas of changes.

The training phase consists in instructing the subject about the type of changes to indicate and how to enter the input. Concerning the type of changes, we asked to point *significant* geometric difference avoiding non-relevant geometric changes. For example, a wall of the scene can present more or less geometric details depending on the position of the laser scanner in the two acquisition sessions even if a real change has not happened. To better assess what significant differences are, during the instruction phase we mentioned explicitly to indicate objects or parts of the scene that appear or disappear or parts of the scene that change their shape significantly. Since we design our technique with the goal to "hide" minor/moderate color changes we deliberately not mentioned anything about color differences. Consider that an evaluation of the selected scenes with the HDR-VDP [MKRH11] proved that all the parts of the scenes have noticeable visual differences. Hence, the task to indicate the significant change is difficult. Despite this, the subjects exhibit good performance in it.

Finally, we instructed the subject how to indicate the detected visual changes. For this purpose, a 7 grid is overdrawn on the scene and the subject has to indicate with a mouse click the tiles where a change is detected (red tiles), with two clicks the tiles that do not change from S_0 to S_1 (blue tiles). The tiles for which the subject is uncertain should remain untagged and are recorded as "no answer". We opt to use the superimposed grid and not use the available change/no-change segmentation to not provide any type of information to the user on the location of the change. The size of the grid has been chosen to be completed in reasonable time. The different viewpoints have been selected in order to align as much as possible the change regions with the cells of the grid.

Table 12 contains the data aggregated for each technique.

3. Second Session - Subjective evaluation

The training phase for this session is simpler and takes less time than the previous one. The subject is instructed to test the different visualization techniques directly and rate them with a score from 1 to 5 according to his/her preference. In this experiment, the subject knows the change/no-change segmentation of the scene. The

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.680(0.136)	437	0.369(0.072)	0.931(0.043)	421	0.415(0.129)	0.46	730
LINEAR	0.758(0.107)	351	0.409(0.100)	0.923(0.051)	643	0.527(0.134)	0.374	595
SMOOTHSTEP1	0.738(0.109)	478	0.497(0.060)	0.958(0.027)	600	0.606(0.099)	0.319	506
SMOOTHSTEP2	0.729(0.118)	410	0.420(0.076)	0.929(0.049)	507	0.409(0.118)	0.412	643

Table 1: *Global results of the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles, we show also a global score that takes into account the percentage of tiles with an answer.The numbers in parenthesis are the corresponding variances.*

change map is displayed on a side monitor during the interactive session with a false color map. Note that all the techniques are visualized simultaneously so that the subject can better appreciate the different effects produced. We asked to evaluate with '1' the techniques that are not effective to show the changes and with '5' the techniques that are very effective. We also asked to take into account the effectiveness in hiding the no-change parts of the scene. The subject evaluates the techniques by moving the time slider provided for each technique. The final recommendation of the training phase is to play with all the range of the slider to better evaluate the results that the specific technique produces.

We analyzed the scores collected to identify and remove scoring bias. To do so, we model the score s_{ij} provided by the subject i for the technique j as:

$$s_{ij} = g_i s_j + b_i + n_{ij} \tag{1}$$

where s_j is the "real" score of the answer j, g_i is a gain factor, b_i is an offset, and n_{ij} is a source of noise sampled from a zero-mean, white Gaussian which models eventual systematic or random errors. In this model, the gain and the offset vary from subject to subject, since any subject provides scores according to an own scale. By aggregating the scores for each technique and performing an analysis-of-variance (ANOVA) we found that a simple mean normalization [Gui54] of the scores is sufficient to remove differences across subjects.

These scores had been also analyzed using a Kurtosis analysis in order to identify a range of values for which a subject can be considered an outlier and then screened. The screening procedure follows the Annex 2 of ITU BT.500 Recommendation [Uni02]. The procedure depends on if the scores distribution can be considered or not a normal distribution. In the case of a normal distribution, the lower bound is set to be $\mu - 2\sigma$, while the upper bound $\mu + 2\sigma$ (μ is the mean of the scores and σ the standard deviation). This limits change to $\mu - \sqrt{20}\sigma$ and $\mu + \sqrt{20}\sigma$ for a non-normal distribution. Then, indicating with P the number of scores under the lower bound limit and with Q the number of scores over the upper bound limit, a subject is screened if $(P+Q)/N > 0.05 \wedge (P-Q)/(P+Q) < 0.3$. According to this procedure, we found that 3 of 24 subjects are outliers. Table 2 shows the scores aggregated per technique with and without outliers screening. Table 3 shows the scores aggregated per scene with and without outliers screening.

	All subjects	Without outliers
SWITCH	1.75(1.13)	1.68(0.89)
LINEAR	2.58(1.47)	2.50(1.40)
SMOOTHSTEP1	3.93(0.94)	4.10(0.70)
SMOOTHSTEP2	3.80(1.12)	3.90(1.09)

Table 2: *Global scores of the second session with and without outliers screening. The numbers in parenthesis are the corresponding variance.*

4. Third Session - Comparison with the direct change map visualization

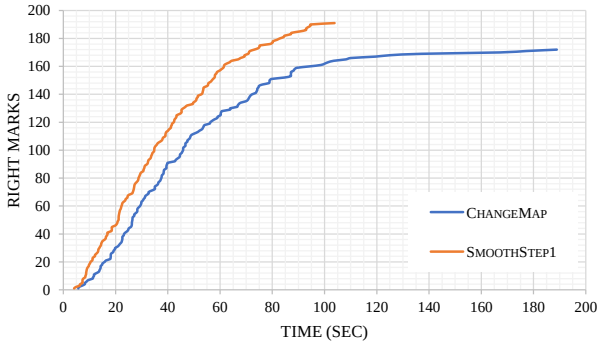
In this test, we compare the proposed technique SMOOTHSTEP1 with a method based on the direct visualization of a binary change map CHANGEMAP. We asked the subject to complete a detection task of a subset of the main geometric changes in a scene not characterized by a significant color change. The subject interacted by moving the time slider to go from one time to the other. For the method CHANGEMAP we used the technique SWITCH for the slider and only for this method we gave the possibility to switch on the change map visualization by pressing a keyboard button. During the change map visualization, the subject can not interact with the slider and mark the change regions. In both the compared techniques, the subject can mark the change regions by double click inside the area of the screen interested by the change in any time. The marked positions are indicated by a small circle. During the training phase, we showed some example of changes that should (without big color change) and should not (with big color changes) be marked.

For each test, we collected all the marks entered by the subject, the elapsed time from the begging of the test when each mark was entered and their right/wrong classification. We classified as right all the marks entered at less of 10 pixels far from a geometric change region with no significant color change. Figure 1 shows the trend of the number of right marks in function of the elapsed time of the test for both the methods and a table with the number of right and wrong (in parenthesis) marks at different times of the test.

	ST.MARTA1	ST.MARTA2	All subject OFFICE	SEAWEED1	GROUND1
SWITCH	1.63(1.20)	1.79(1.30)	2.21(1.22)	1.38(0.77)	1.75(0.98)
LINEAR	2.96(1.52)	2.63(1.37)	2.62(1.56)	2.13(1.24)	2.38(1.46)
SMOOTHSTEP1	3.75(1.41)	3.75(0.80)	3.83(0.67)	4.17(1.01)	4.17(0.75)
SMOOTHSTEP2	3.79(1.13)	3.79(1.39)	3.63(1.03)	3.88(1.16)	3.92(1.04)

	ST.MARTA1	ST.MARTA2	Without outliers OFFICE	SEAWEED1	GROUND1
SWITCH	1.47(0.73)	1.72(0.87)	2.33(1.17)	1.29(0.50)	1.57(0.53)
LINEAR	2.95(1.57)	2.57(1.20)	2.62(1.38)	1.90(0.94)	2.43(1.29)
SMOOTHSTEP1	4.05(0.81)	3.86(0.7)	3.86(0.69)	4.38(0.52)	4.33(0.51)
SMOOTHSTEP2	3.86(1.17)	3.86(1.46)	3.67(1.08)	4.00(0.86)	4.10(0.75)

Table 3: *Scores of the second session aggregated by scene with and without outliers screening. The numbers in parenthesis are the corresponding variance.*



	Time 20*s*	40*s*	60*s*	80*s*	End
CHANGEMAP	30 (0)	90 (2)	124 (2)	151 (2)	172 (2)
SMOOTHSTEP1	46 (2)	113 (5)	157 (5)	176 (5)	191 (6)

Figure 1: *Graph of the aggregated number of the right marks on the change areas in function of the elapsed time of the test. The bottom table shows the number of right marker at several times of the test (in parenthesis the wrong marks). The results show how the method* SMOOTHSTEP1 *allows the subject to note more changed areas in less time with respect to the method* CHANGEMAP *with a limited loss of accuracy.*

References

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[War04] WARE C.: *Information Visualization: Perception for Design*. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 2004. 1

Scenes Used in the Tests with the Inputs Provided by the Users in the Objective and Subjective Evaluation

SCENE - ST.MARTA1

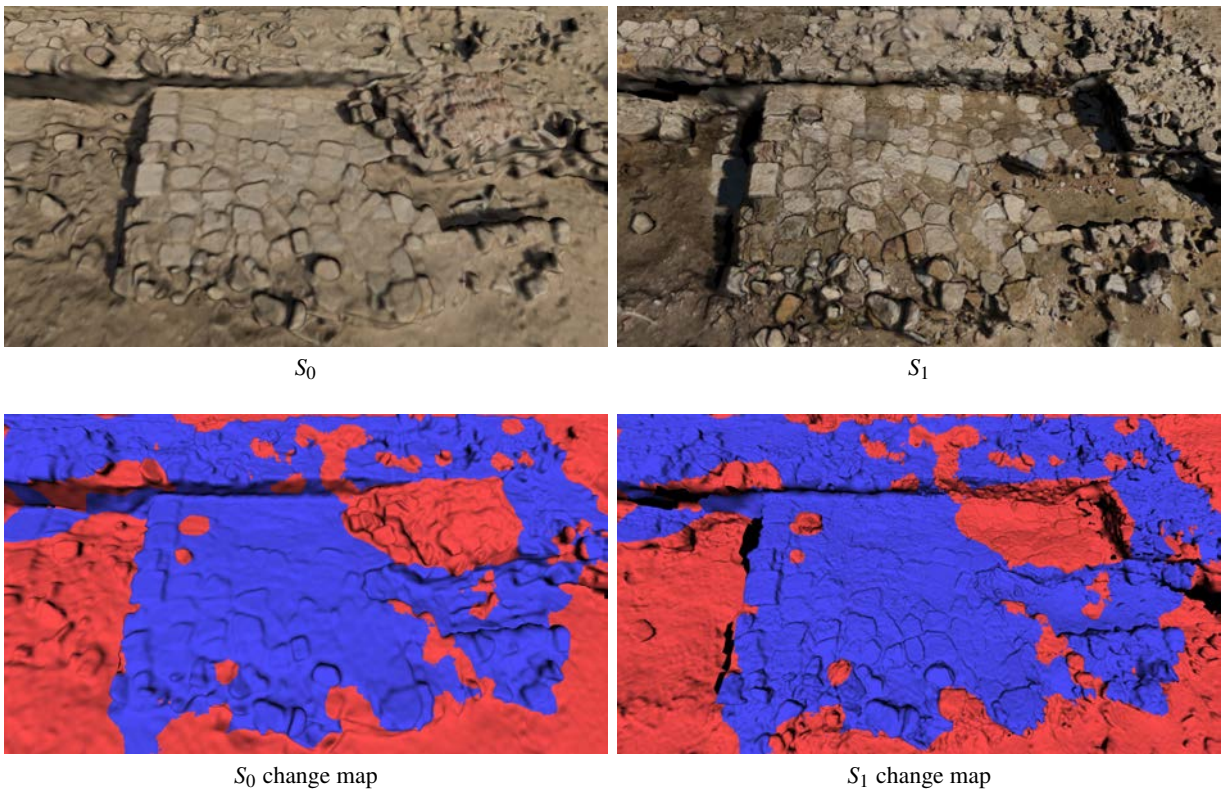


Figure 2: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.735(0.100)	43	0.384(0.084)	0.843(0.094)	40	0.248(0.095)	0.506	85
LINEAR	0.815(0.059)	26	0.264(0.030)	0.868(0.098)	19	0.244(0.044)	0.679	95
SMOOTHSTEP1	0.809(0.044)	40	0.409(0.027)	0.905(0.056)	31	0.432(0.050)	0.493	69
SMOOTHSTEP2	0.811(0.047)	31	0.300(0.067)	0.897(0.065)	21	0.254(0.114)	0.629	88

Table 4: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

	All subjects	Without outliers
SWITCH	1.62(1.15)	1.48(0.73)
LINEAR	2.96(1.46)	2.95(1.57)
SMOOTHSTEP1	3.75(1.35)	4.05(0.81)
SMOOTHSTEP2	3.79(1.08)	3.86(1.17)

Table 5: *Scores of the second session with and without outliers screening. In parenthesis the corresponding variance.*

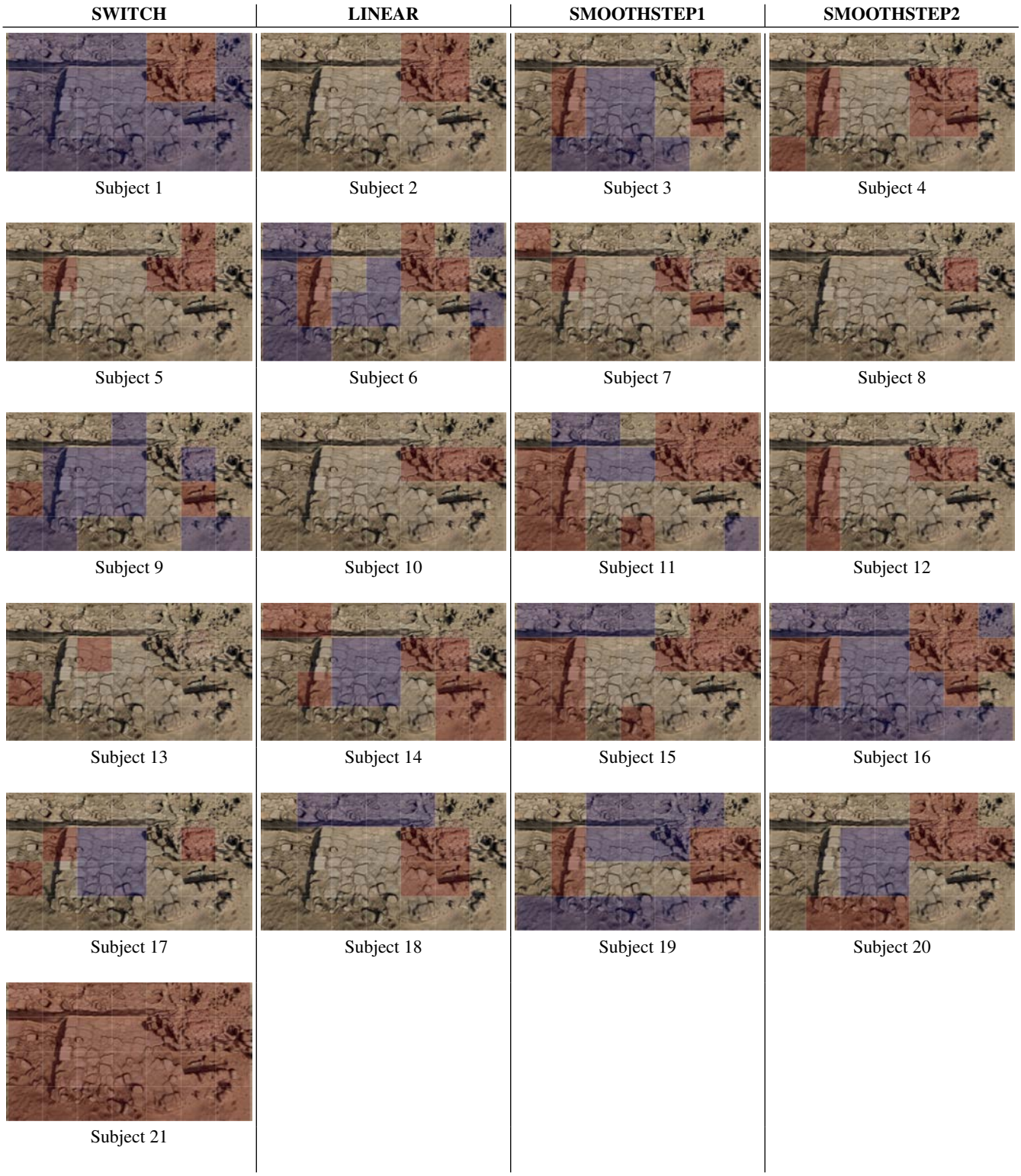
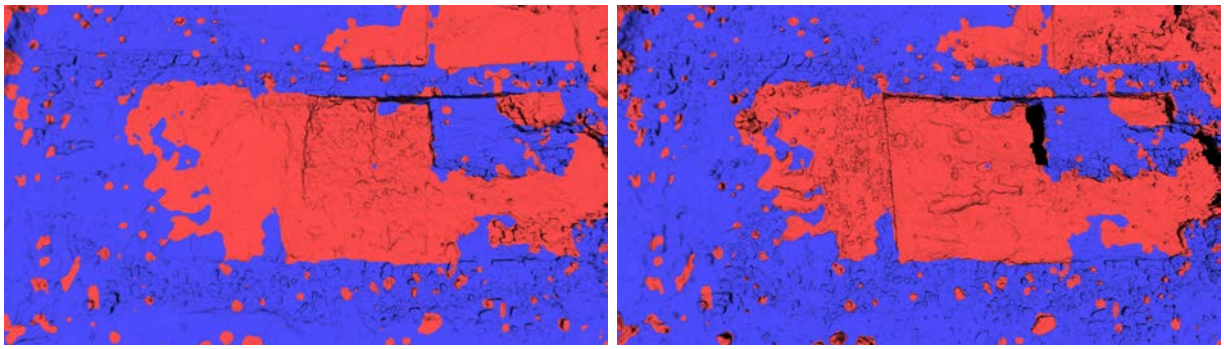


Figure 3: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - ST.MARTA2

S_0 S_1



S_0 change map S_1 change map

Figure 4: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.697(0.134)	36	0.359(0.040)	0.785(0.085)	36	0.336(0.096)	0.486	68
LINEAR	0.729(0.126)	30	0.423(0.076)	0.799(0.098)	63	0.427(0.068)	0.446	75
SMOOTHSTEP1	0.904(0.049)	41	0.554(0.083)	0.863(0.078)	47	0.473(0.154)	0.371	52
SMOOTHSTEP2	0.822(0.102)	40	0.395(0.053)	0.808(0.097)	26	0.240(0.096)	0.529	74

Table 6: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

	All subjects	Without outliers
SWITCH	1.79(1.25)	1.71(0.87)
LINEAR	2.62(1.32)	2.57(1.20)
SMOOTHSTEP1	3.75(0.77)	3.86(0.69)
SMOOTHSTEP2	3.79(1.33)	3.86(1.46)

Table 7: *Scores of the second session with and without outliers screening. In parenthesis the corresponding variance.*

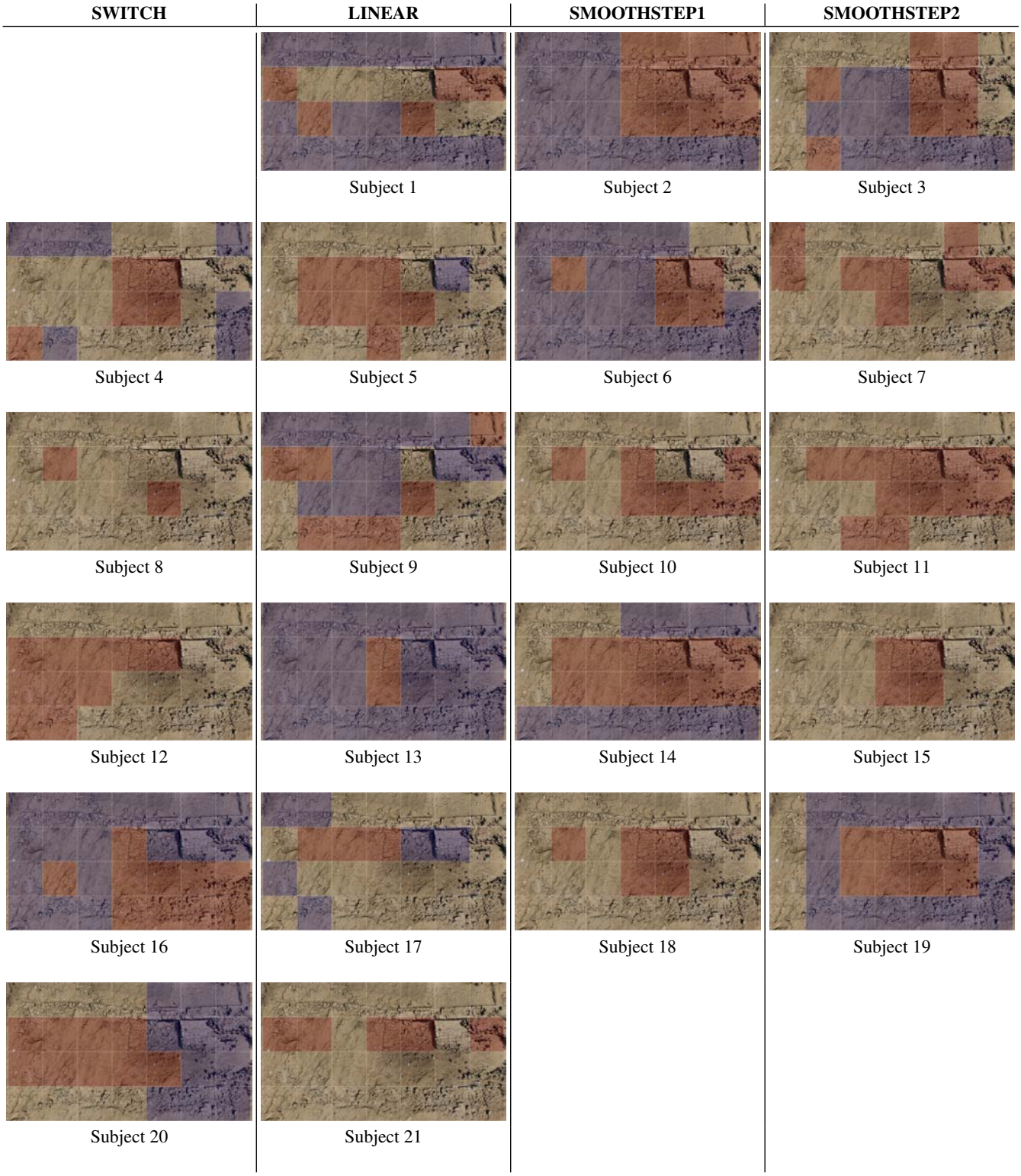
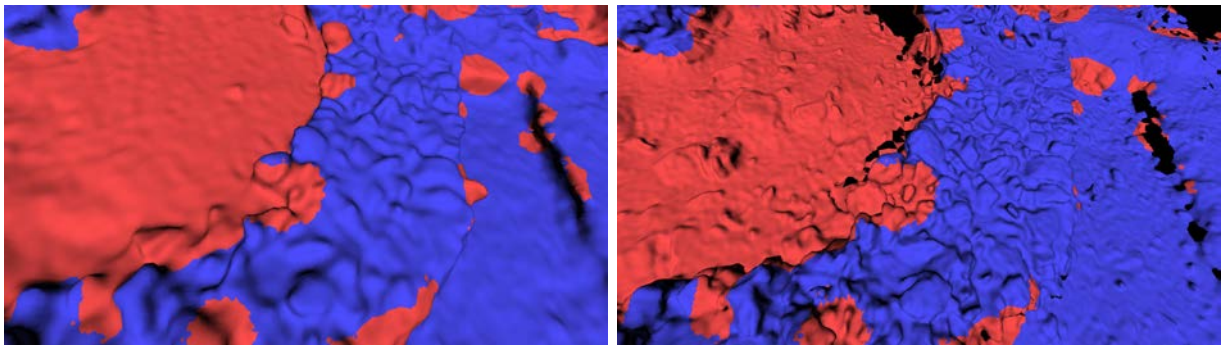


Figure 5: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - ST.MARTA3

S_0 S_1



S_0 change map S_1 change map

Figure 6: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.693(0.156)	72	0.470(0.015)	0.967(0.021)	20	0.349(0.102)	0.343	48
LINEAR	0.728(0.161)	45	0.511(0.105)	0.850(0.113)	47	0.474(0.156)	0.343	48
SMOOTHSTEP1	0.724(0.145)	66	0.495(0.036)	0.958(0.027)	48	0.495(0.064)	0.321	54
SMOOTHSTEP2	0.906(0.073)	37	0.529(0.110)	0.940(0.049)	47	0.570(0.098)	0.400	56

Table 8: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

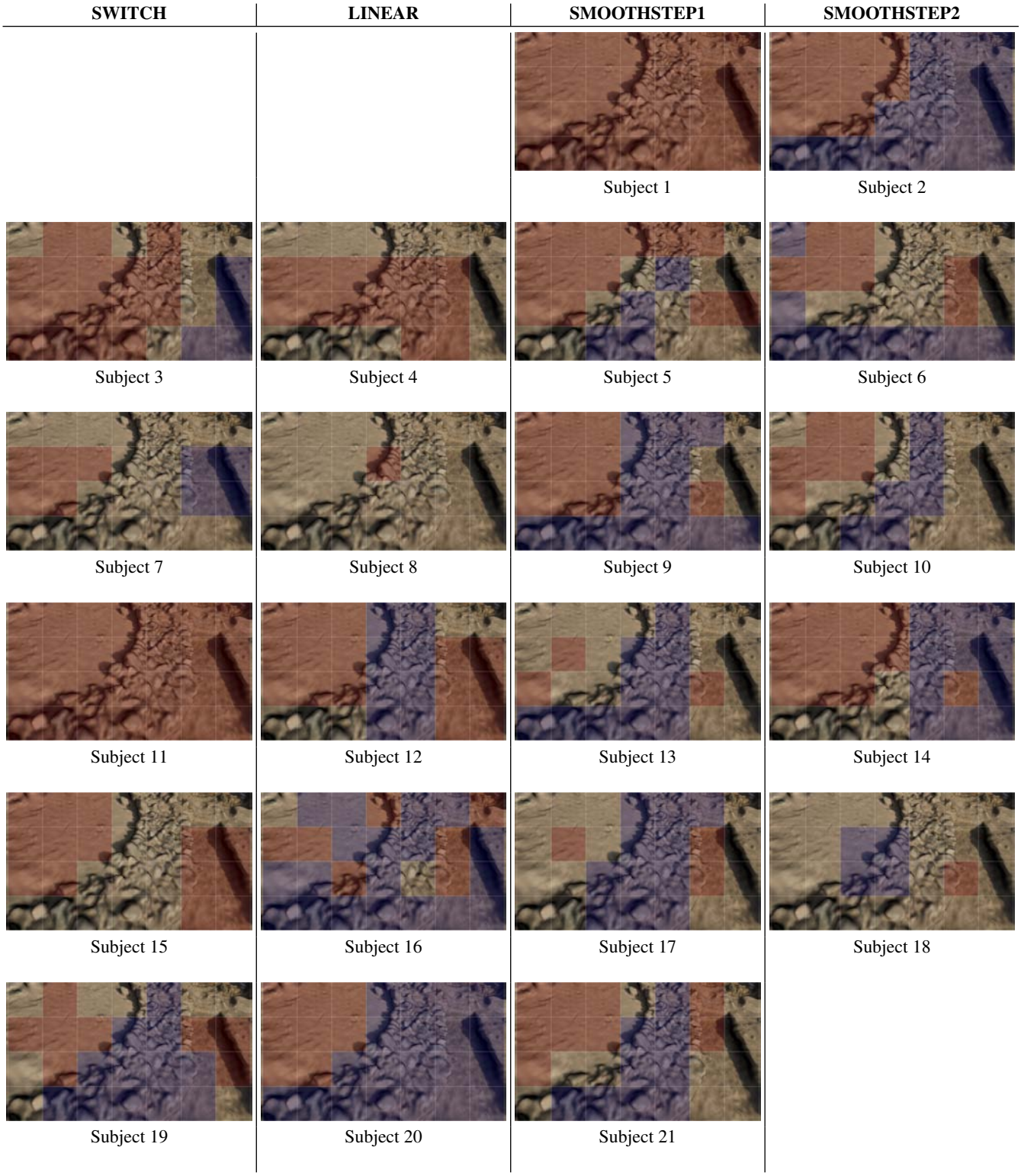


Figure 7: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - PARIS

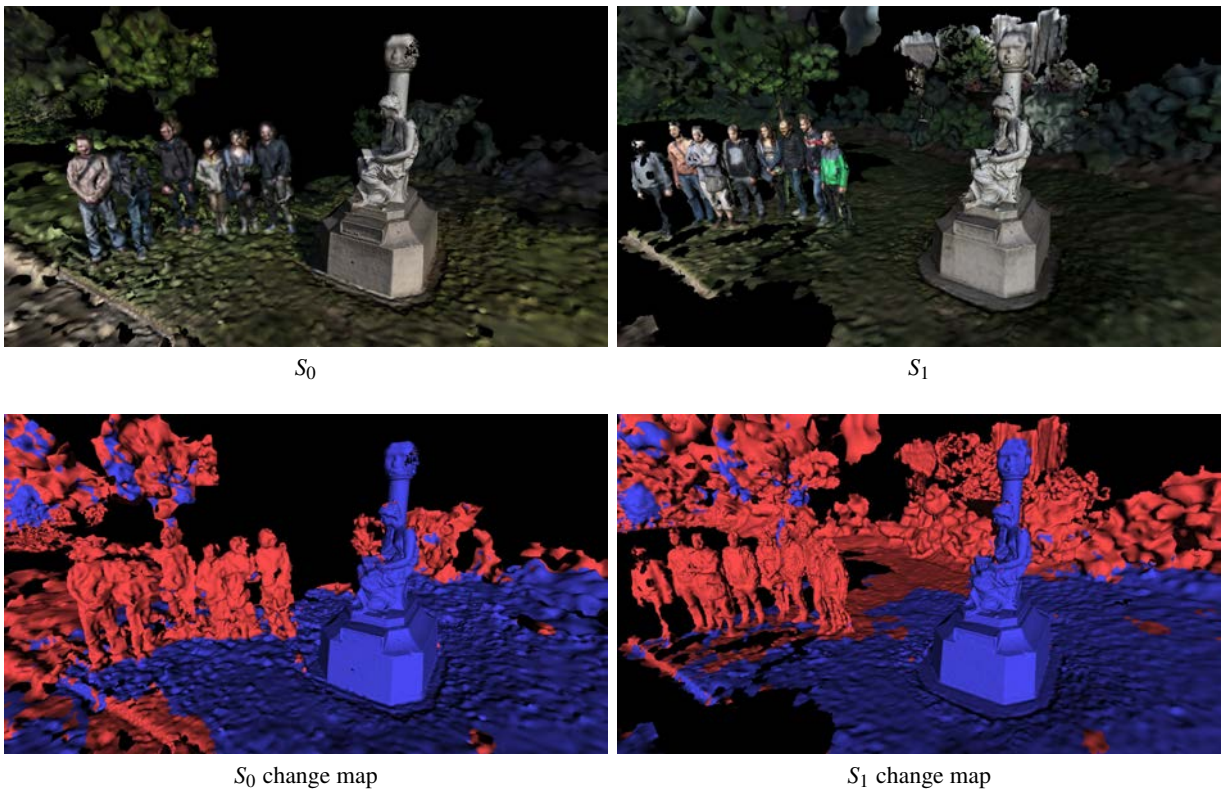


Figure 8: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.932(0.038)	55	0.460(0.022)	0.886(0.034)	14	0.320(0.072)	0.507	71
LINEAR	0.972(0.010)	56	0.700(0.035)	0.727(0.119)	45	0.536(0.021)	0.279	39
SMOOTHSTEP1	0.900(0.068)	74	0.665(0.078)	0.795(0.108)	28	0.588(0.091)	0.271	38
SMOOTHSTEP2	0.970(0.011)	64	0.703(0.021)	0.785(0.123)	58	0.602(0.012)	0.274	46

Table 9: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

Figure 9: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - OFFICE

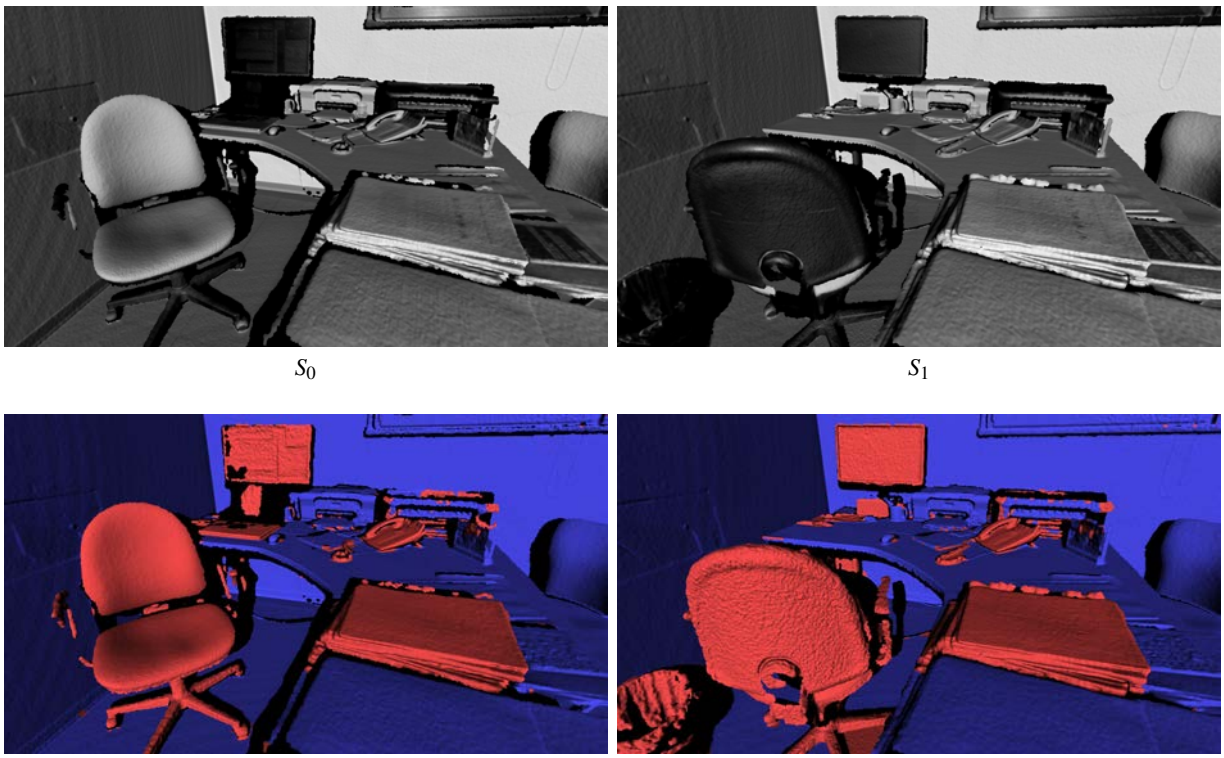


Figure 10: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.853(0.078)	59	0.749(0.038)	0.915(0.060)	85	0.795(0.036)	0.143	24
LINEAR	0.946(0.028)	27	0.652(0.109)	0.837(0.103)	70	0.551(0.119)	0.307	43
SMOOTHSTEP1	0.900(0.050)	32	0.615(0.037)	0.917(0.060)	63	0.629(0.018)	0.321	45
SMOOTHSTEP2	0.812(0.094)	49	0.662(0.092)	0.903(0.064)	61	0.709(0.128)	0.214	30

Table 10: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

	All subjects	Without outliers
SWITCH	2.21(1.16)	2.33(1.11)
LINEAR	2.79(1.50)	2.62(1.38)
SMOOTHSTEP1	3.83(0.64)	3.86(0.69)
SMOOTHSTEP2	3.62(0.98)	3.67(1.08)

Table 11: *Scores of the second session with and without outliers screening. In parenthesis the corresponding variance.*

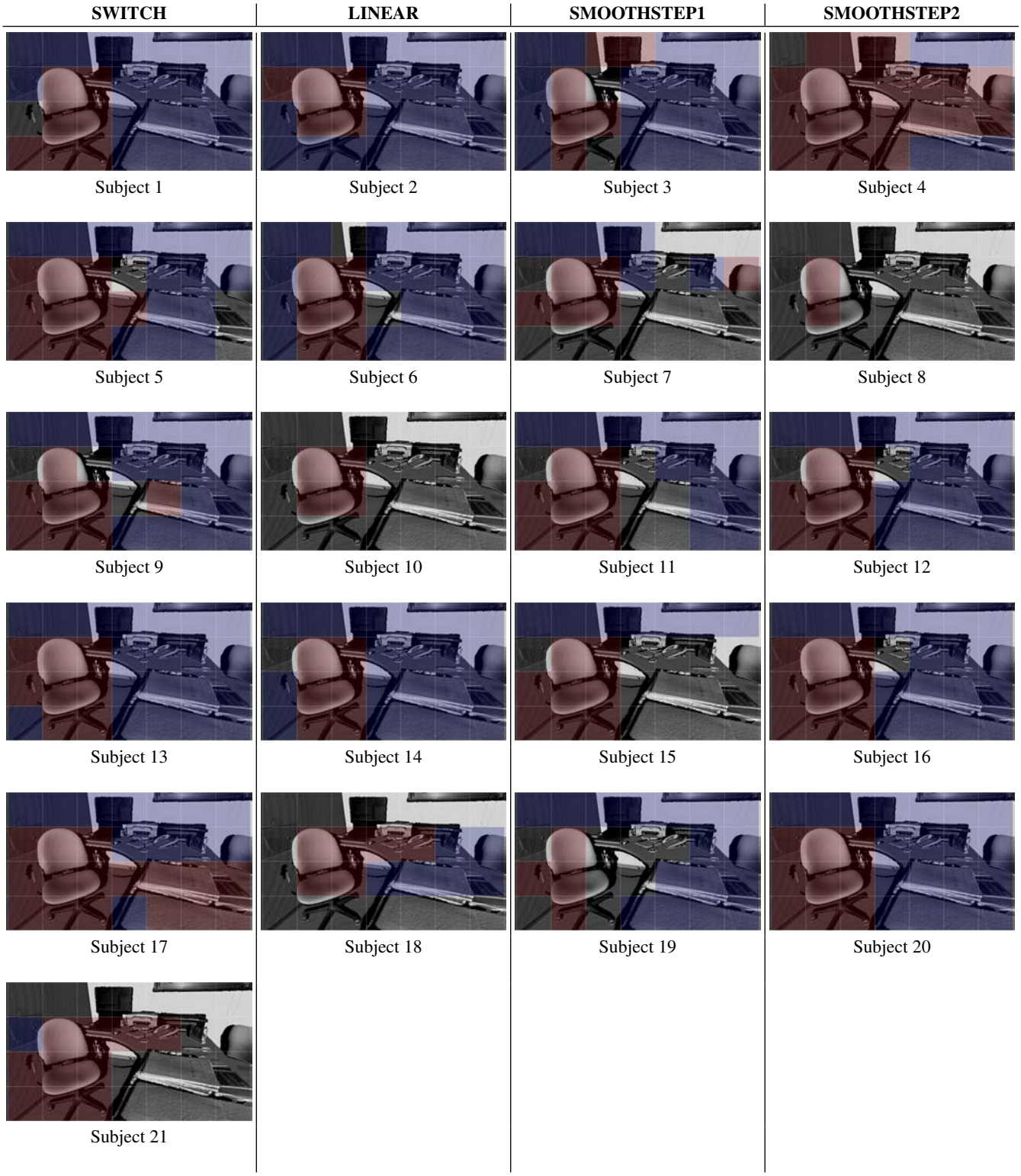


Figure 11: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - LAB1

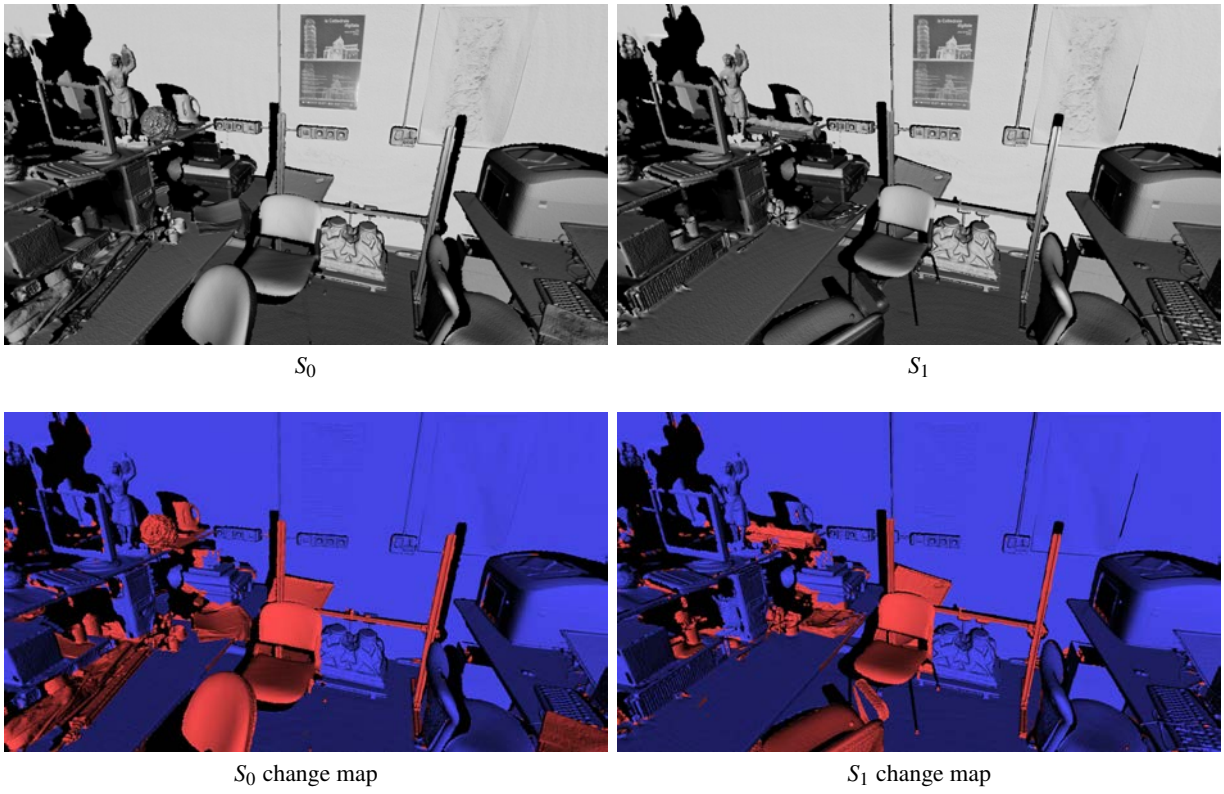


Figure 12: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.668(0.083)	35	0.450(0.062)	0.976(0.013)	56	0.530(0.189)	0.350	49
LINEAR	0.753(0.055)	46	0.613(0.030)	0.990(0.004)	88	0.791(0.018)	0.202	34
SMOOTHSTEP1	0.783(0.052)	42	0.575(0.059)	1.000(0.000)	58	0.657(0.150)	0.286	40
SMOOTHSTEP2	0.730(0.070)	33	0.438(0.010)	0.991(0.003)	52	0.602(0.020)	0.393	55

Table 12: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

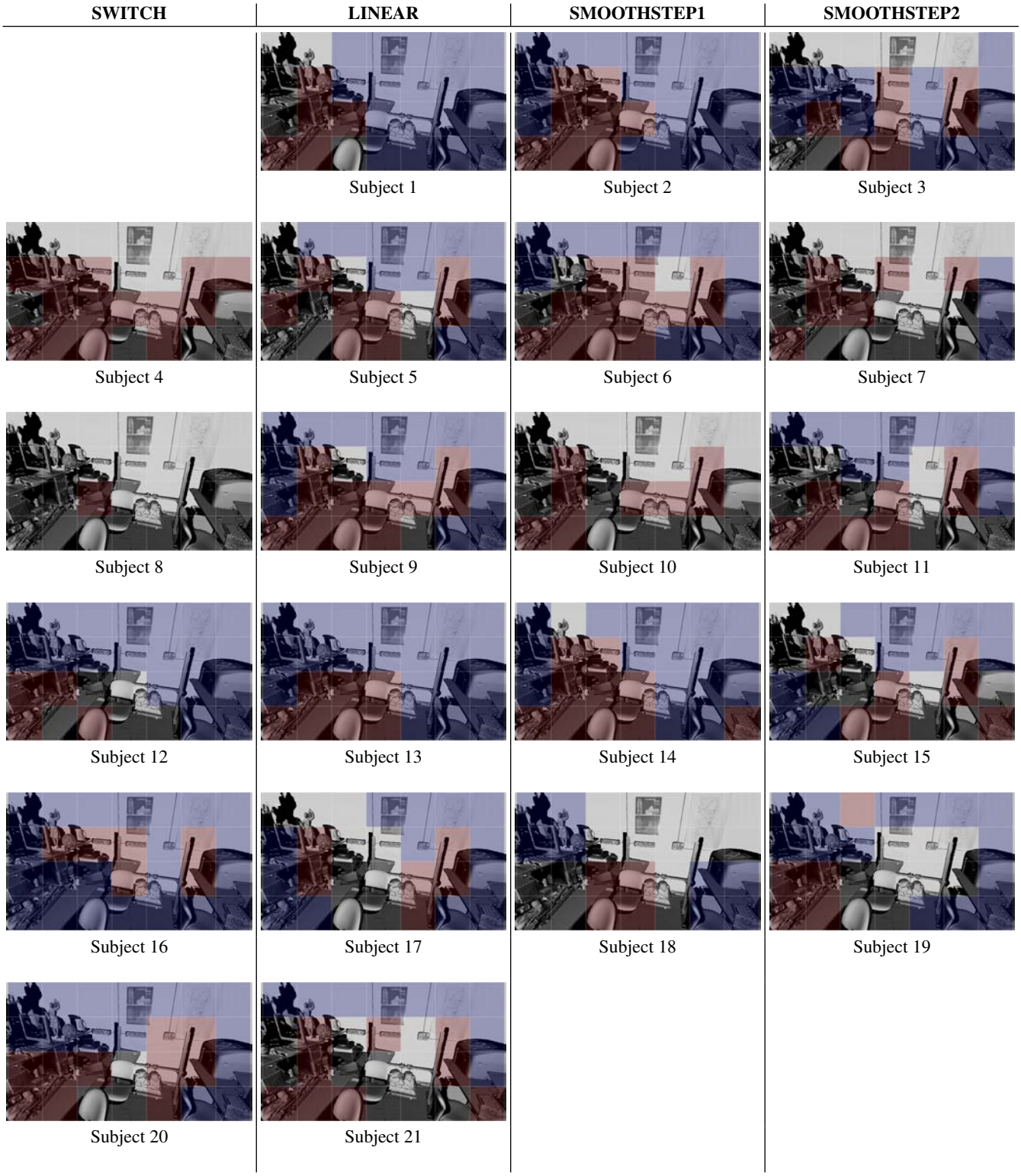


Figure 13: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - LAB2

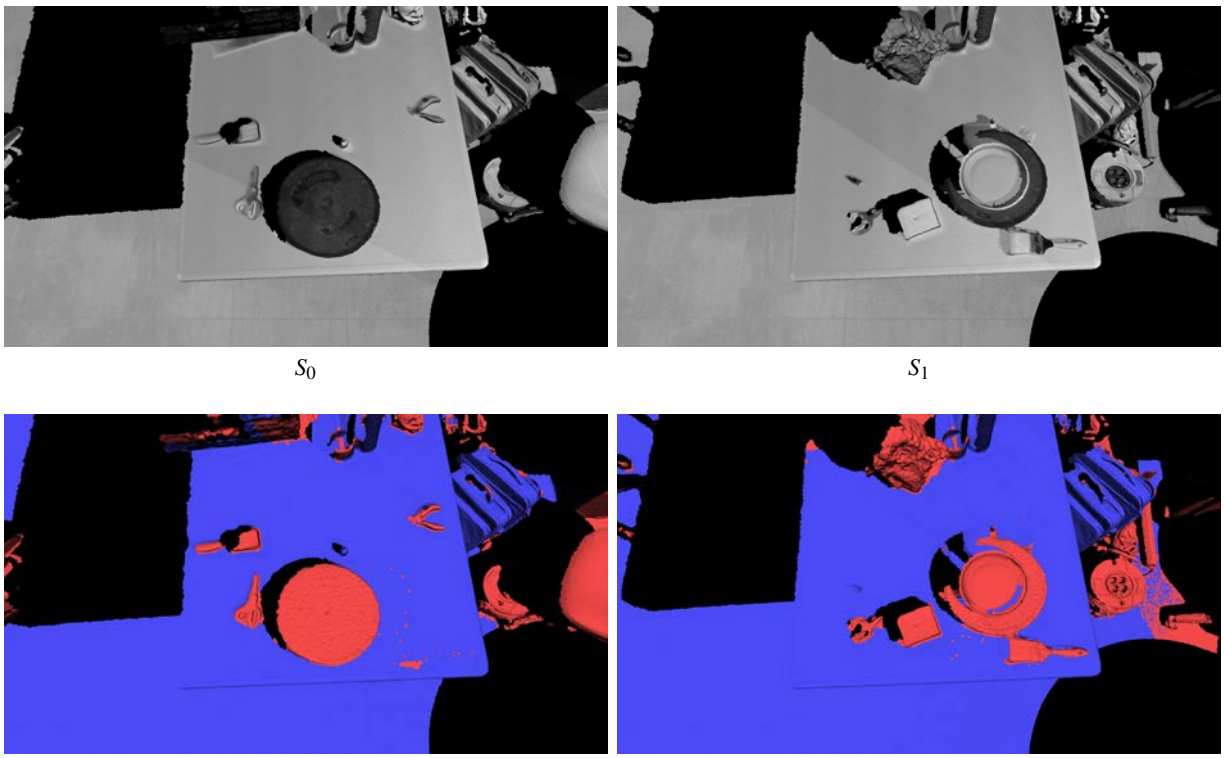


Figure 14: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.792(0.061)	38	0.514(0.040)	0.879(0.072)	36	0.520(0.086)	0.357	41
LINEAR	0.791(0.070)	55	0.616(0.083)	0.961(0.012)	32	0.560(0.212)	0.243	28
SMOOTHSTEP1	0.769(0.071)	57	0.593(0.013)	0.941(0.016)	49	0.715(0.024)	0.232	32
SMOOTHSTEP2	0.793(0.061)	40	0.556(0.028)	0.838(0.097)	43	0.550(0.102)	0.278	32

Table 13: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

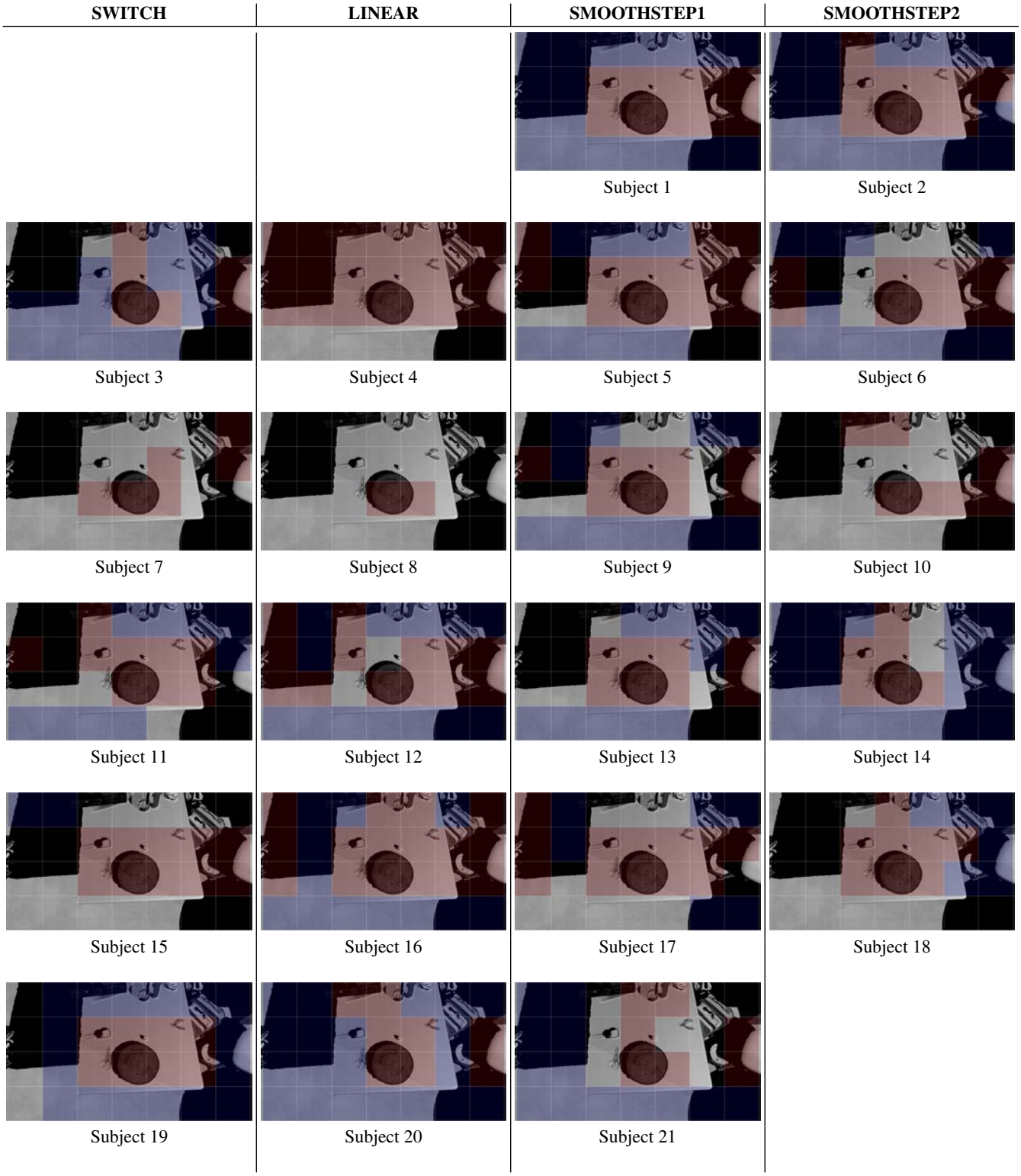


Figure 15: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - SEAWEED1

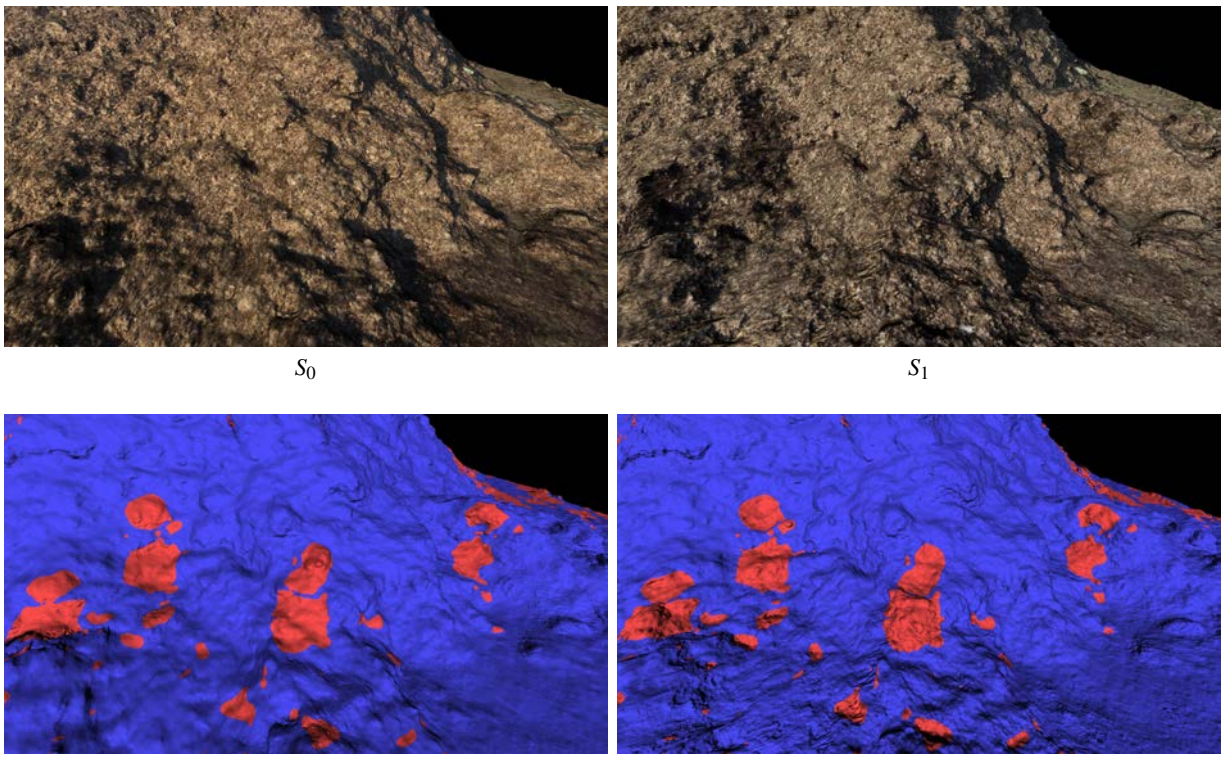


Figure 16: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.415(0.115)	20	0.104(0.016)	1.000(0.000)	12	0.193(0.069)	0.763	103
LINEAR	0.591(0.113)	25	0.230(0.029)	1.000(0.000)	25	0.244(0.113)	0.630	85
SMOOTHSTEP1	0.478(0.119)	33	0.354(0.040)	1.000(0.000)	60	0.674(0.122)	0.311	42
SMOOTHSTEP2	0.441(0.112)	41	0.289(0.060)	1.000(0.000)	51	0.543(0.104)	0.432	70

Table 14: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

	All subjects	Without outliers
SWITCH	1.38(0.73)	1.29(0.49)
LINEAR	2.12(1.19)	1.90(0.94)
SMOOTHSTEP1	4.17(0.97)	4.38(0.52)
SMOOTHSTEP2	3.88(1.11)	4.00(0.86)

Table 15: *Scores of the second session with and without outliers screening. In parenthesis the corresponding variance.*

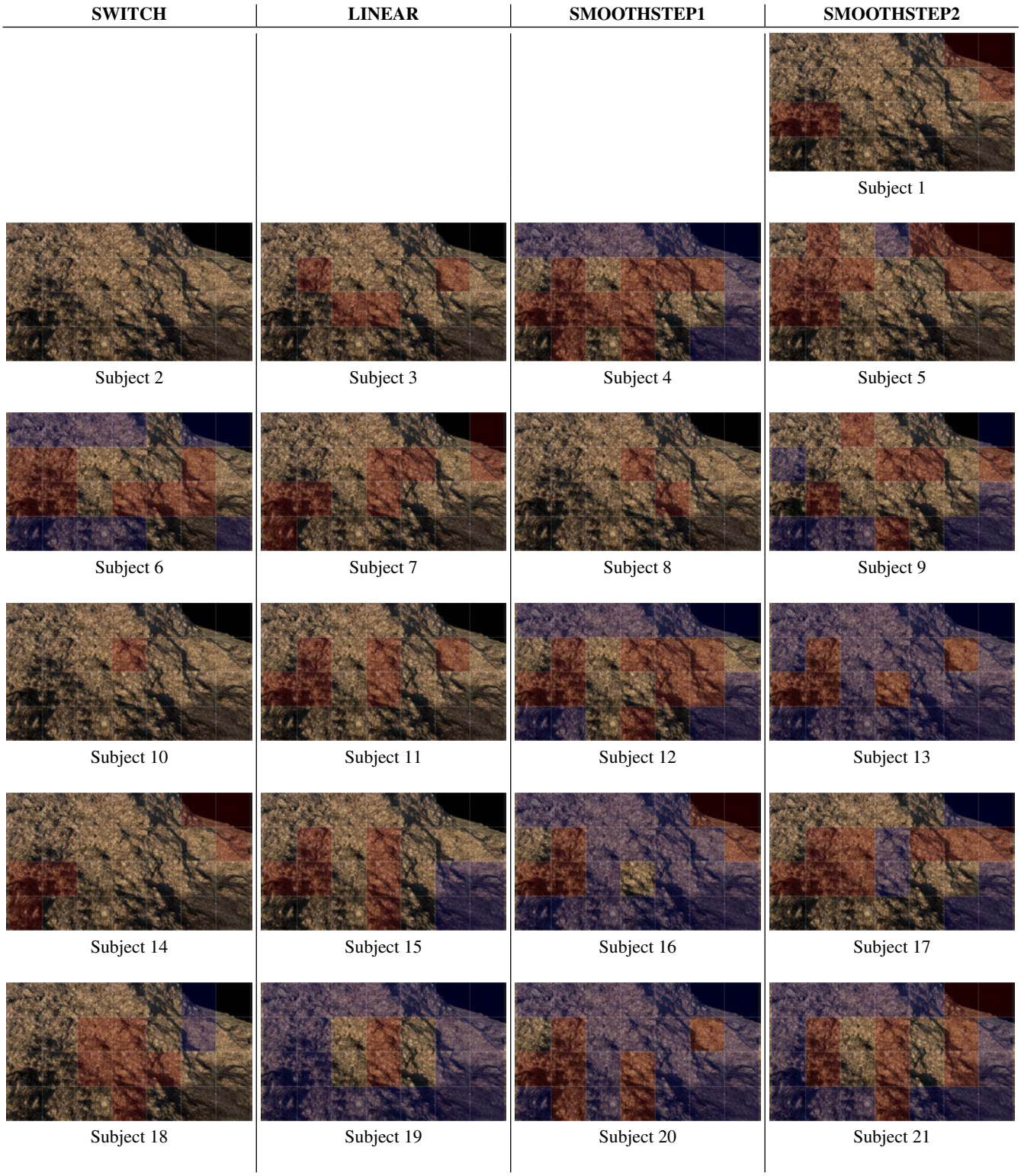


Figure 17: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - SEAWEED2

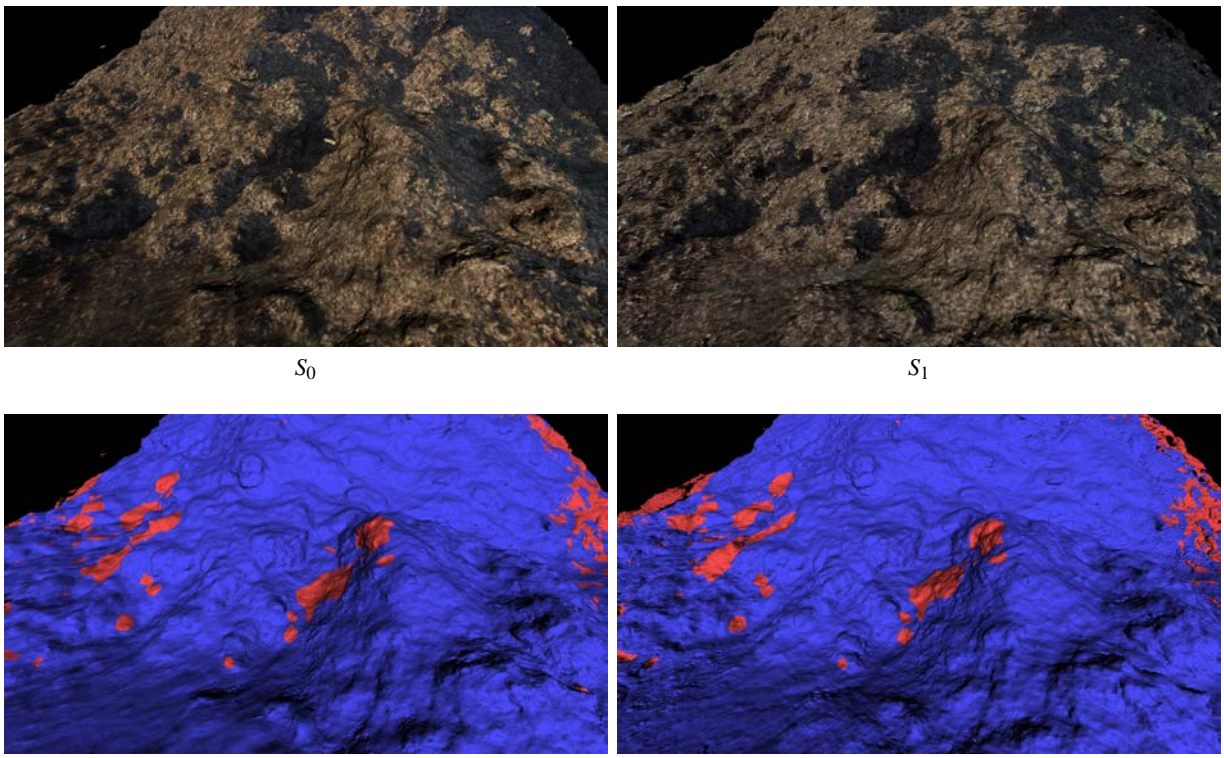


Figure 18: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.257(0.068)	34	0.102(0.007)	1.000(0.000)	24	0.278(0.100)	0.642	104
LINEAR	0.194(0.032)	8	0.029(0.003)	1.000(0.000)	79	0.644(0.121)	0.356	48
SMOOTHSTEP1	0.387(0.058)	29	0.189(0.006)	1.000(0.000)	39	0.452(0.090)	0.496	67
SMOOTHSTEP2	0.359(0.053)	23	0.204(0.020)	1.000(0.000)	55	0.519(0.191)	0.422	57

Table 16: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

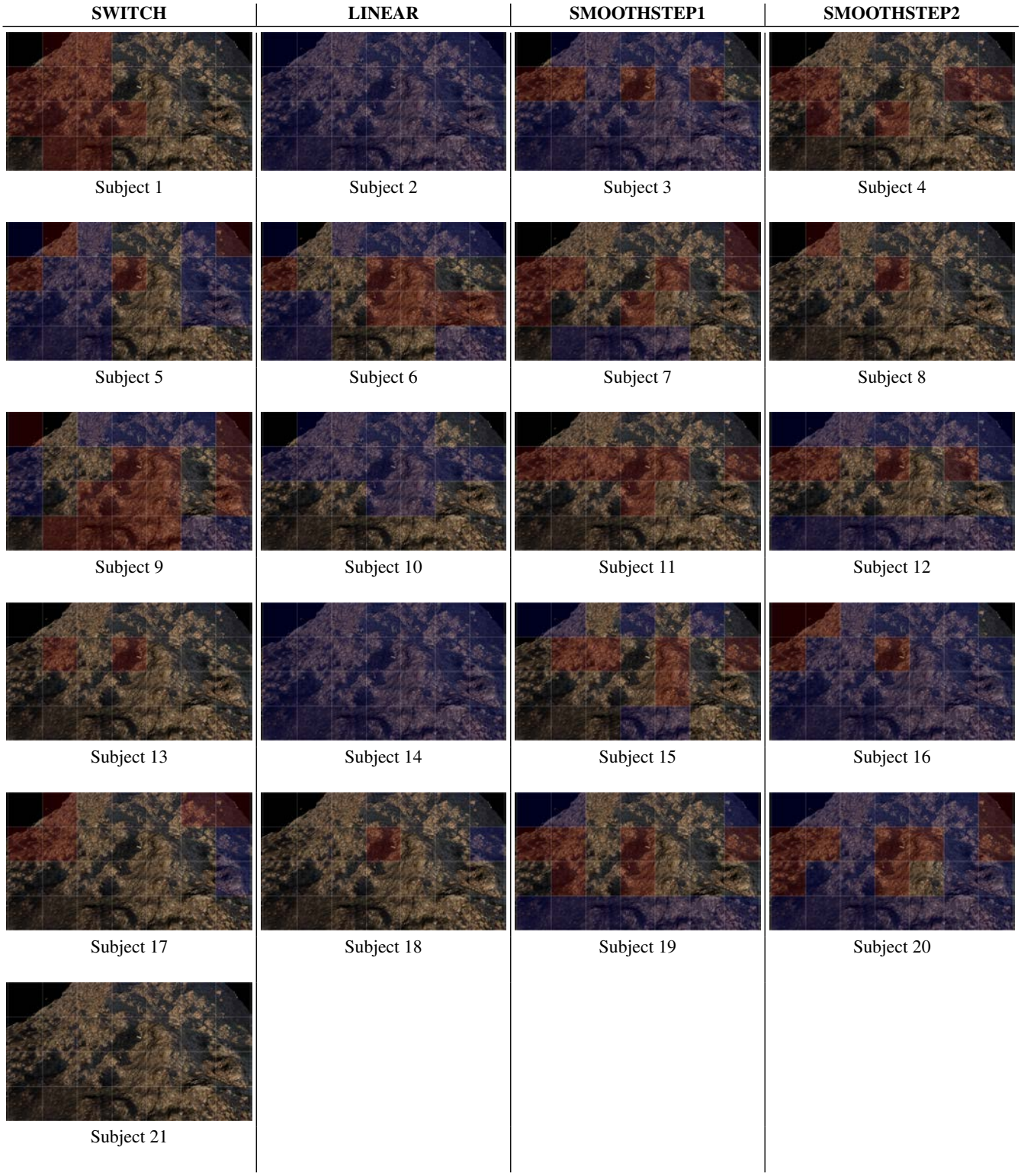


Figure 19: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - GROUND1

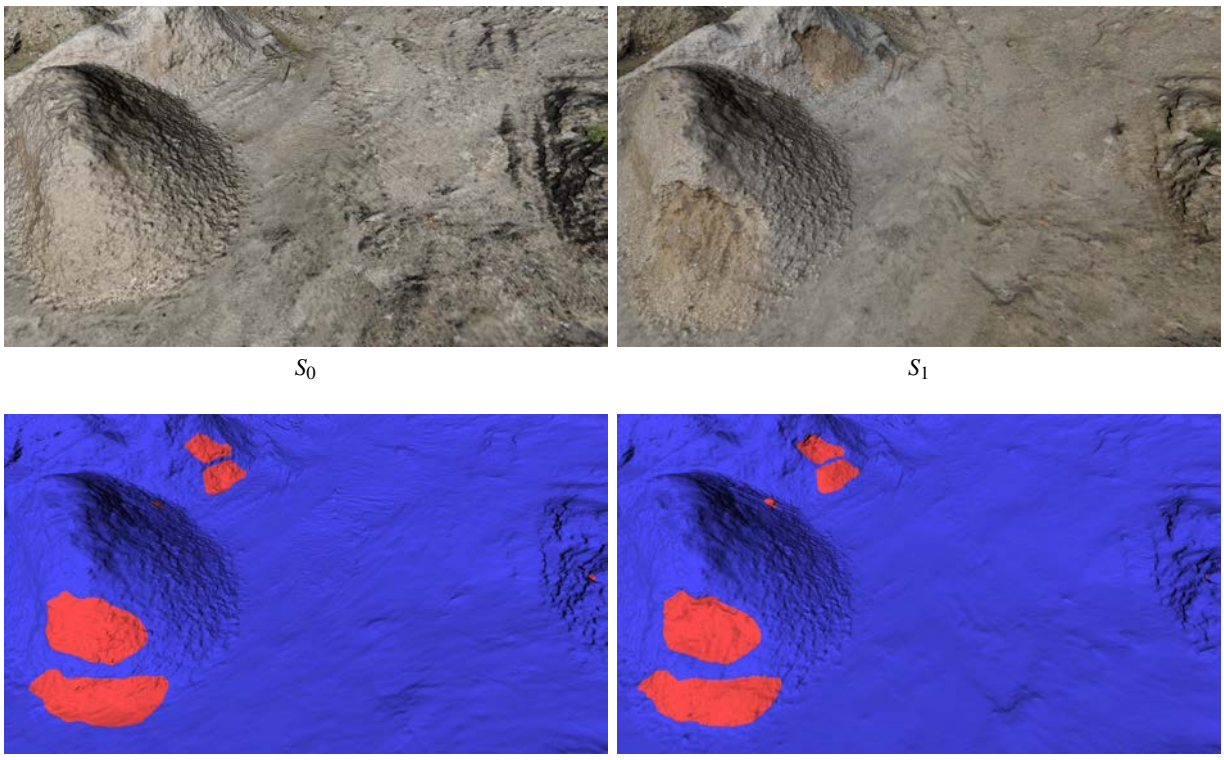


Figure 20: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.514(0.101)	19	0.304(0.041)	1.000(0.000)	67	0.571(0.219)	0.386	54
LINEAR	0.425(0.132)	22	0.260(0.063)	1.000(0.000)	96	0.685(0.106)	0.298	50
SMOOTHSTEP1	0.488(0.112)	29	0.367(0.053)	1.000(0.000)	64	0.614(0.156)	0.336	47
SMOOTHSTEP2	0.311(0.118)	29	0.136(0.006)	1.000(0.000)	28	0.357(0.059)	0.593	83

Table 17: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

	All subjects	Without outliers
SWITCH	1.75(0.94)	1.57(0.53)
LINEAR	2.38(1.40)	2.43(1.29)
SMOOTHSTEP1	4.17(0.72)	4.33(0.51)
SMOOTHSTEP2	3.92(0.99)	4.10(0.75)

Table 18: *Scores of the second session with and without outliers screening. In parenthesis the corresponding variance.*

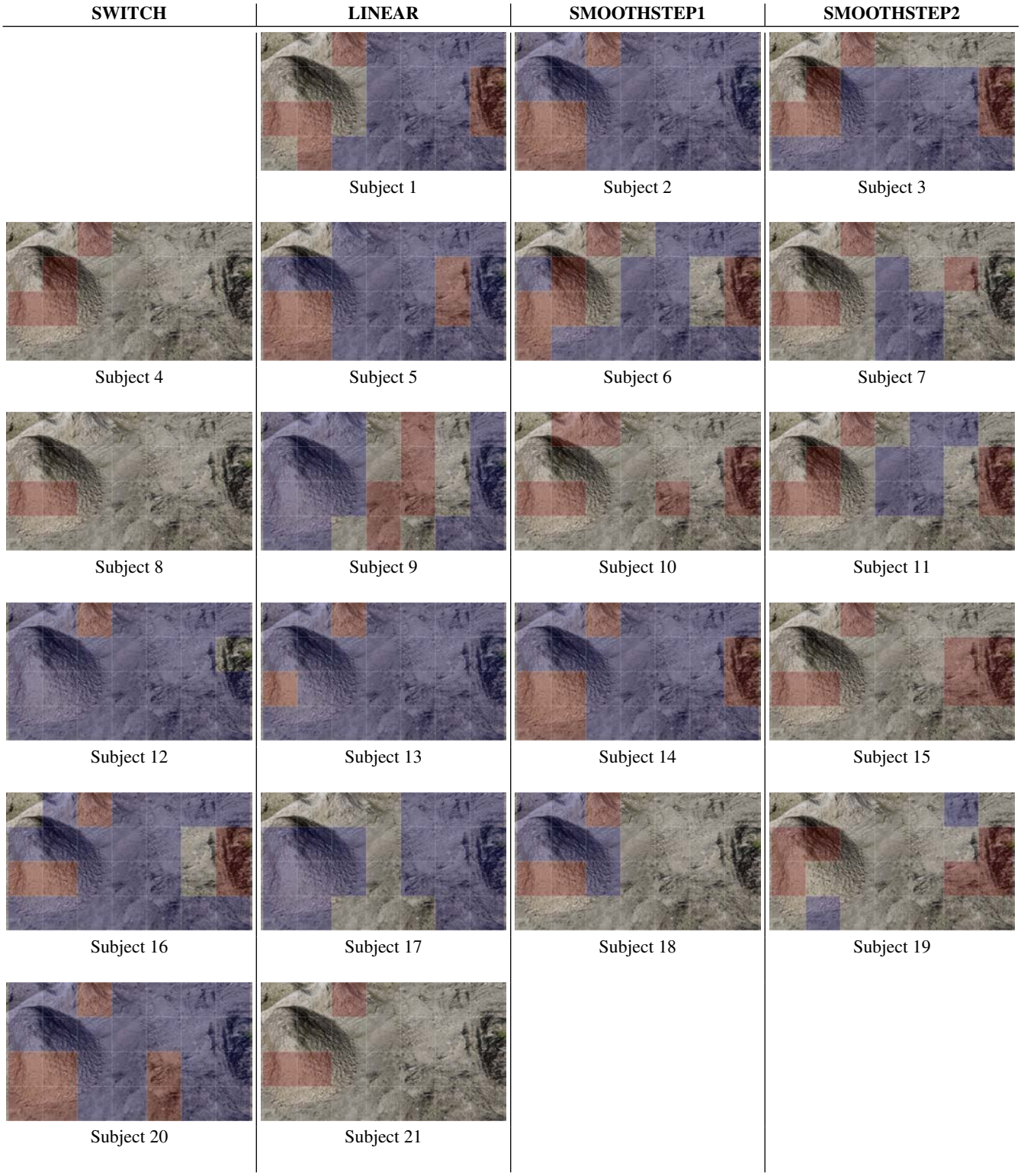


Figure 21: *Final data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.*

SCENE - GROUND2

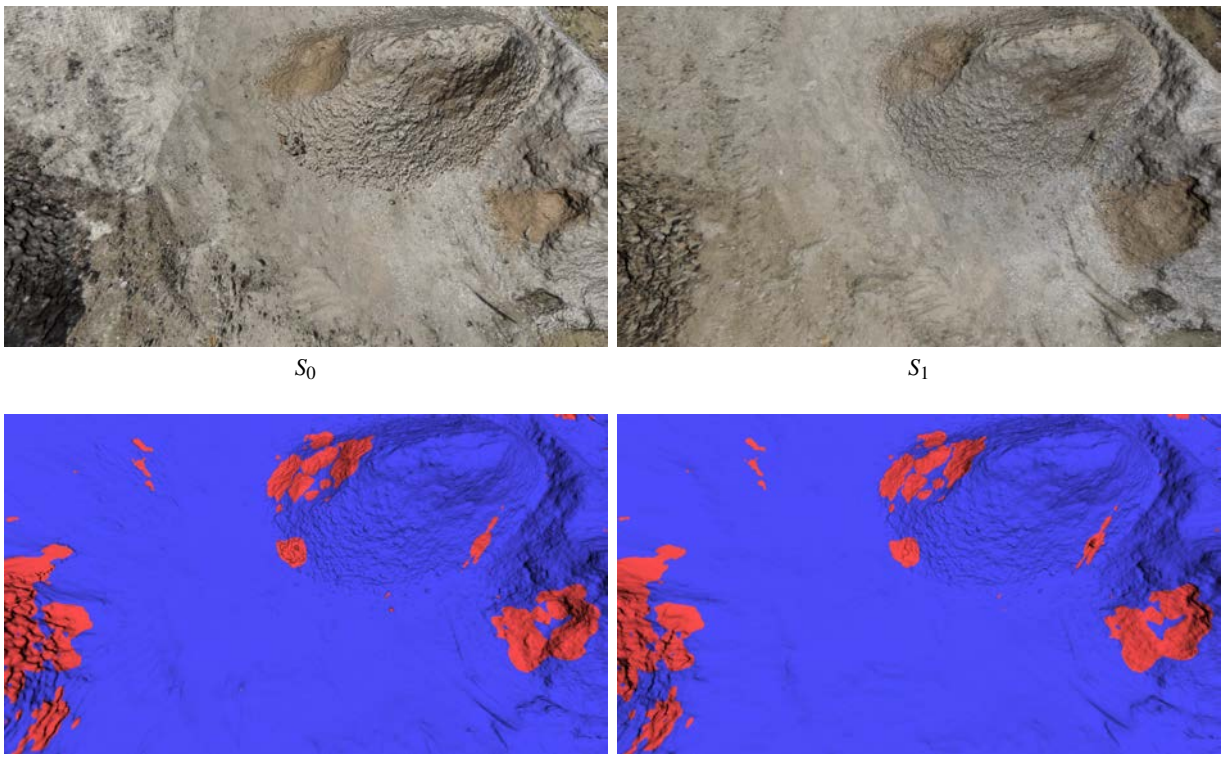
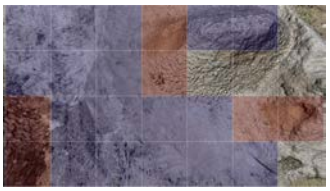
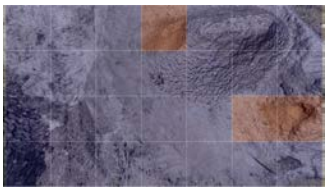
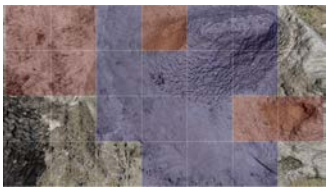
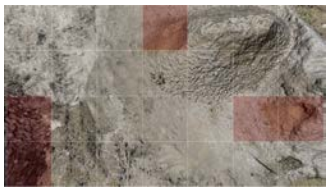
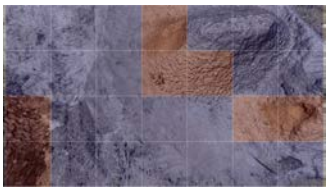
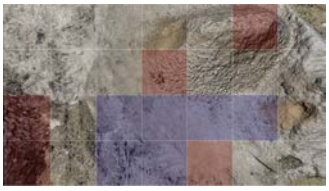
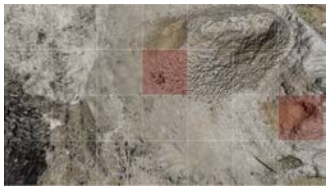
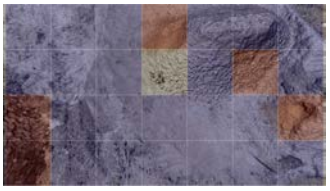
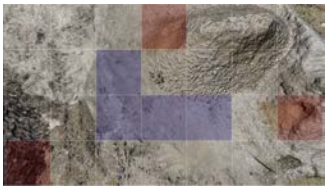
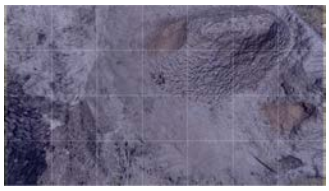
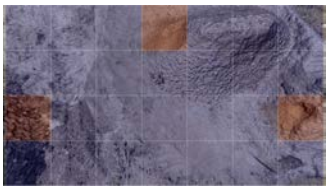
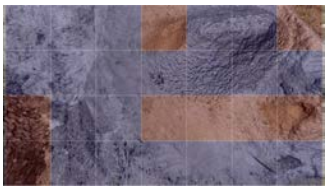
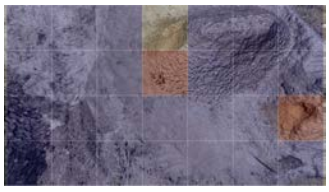
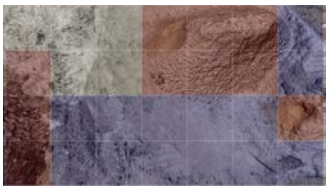
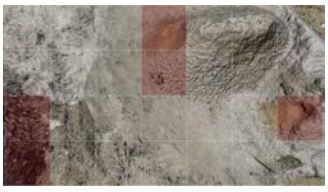
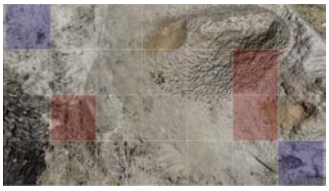
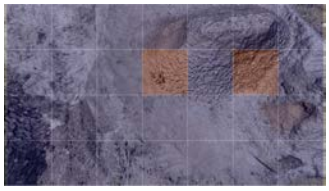
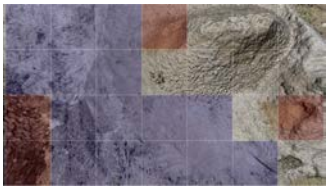


Figure 22: *Viewpoint used in the user study with the corresponding change maps for each model (blue = no-change, red = change).*

	Change			No-Change			No-Answer	
	C	#Tiles	Score	*NC*	#Tiles	Score	*NA*	#Tiles
SWITCH	0.336(0.143)	26	0.136(0.012)	1.000(0.000)	31	0.407(0.036)	0.593	83
LINEAR	0.590(0.134)	11	0.188(0.043)	0.981(0.005)	79	0.582(0.226)	0.357	50
SMOOTHSTEP1	0.632(0.134)	35	0.614(0.032)	1.000(0.000)	113	0.881(0.014)	0.119	20
SMOOTHSTEP2	0.616(0.140)	23	0.380(0.041)	0.995(0.002)	65	0.590(0.161)	0.371	52

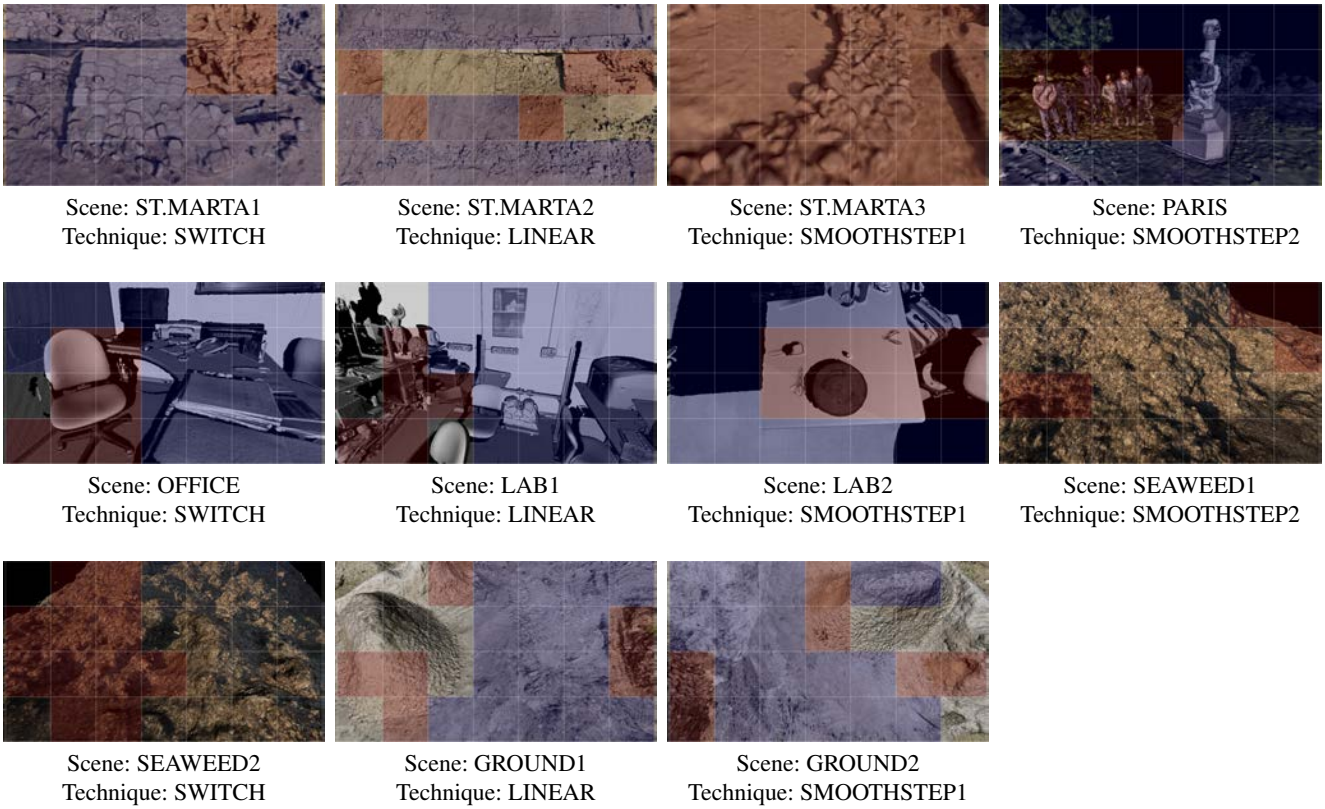
Table 19: *Results of the first user study session on the scene. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles). For the change and no-change tiles we show also a global score that takes into account the percentage of tiles with an answer.*

SWITCH	LINEAR	SMOOTHSTEP1	SMOOTHSTEP2
		 Subject 1	 Subject 2
 Subject 3	 Subject 4	 Subject 5	 Subject 6
 Subject 7	 Subject 8	 Subject 9	 Subject 10
 Subject 11	 Subject 12	 Subject 13	 Subject 14
 Subject 15	 Subject 16	 Subject 17	 Subject 18
 Subject 19	 Subject 20	 Subject 21	

captionoffigureFinal data produced by the subjects in the first user study session for the scene. The images in column are relative to tests performed with the same visualization technique.

Change/NoChange Markings Provided in the Objective Evaluation by Each User

Subject 1 - Session 1



Scene: ST.MARTA1
Technique: SWITCH

Scene: ST.MARTA2
Technique: LINEAR

Scene: ST.MARTA3
Technique: SMOOTHSTEP1

Scene: PARIS
Technique: SMOOTHSTEP2

Scene: OFFICE
Technique: SWITCH

Scene: LAB1
Technique: LINEAR

Scene: LAB2
Technique: SMOOTHSTEP1

Scene: SEAWEED1
Technique: SMOOTHSTEP2

Scene: SEAWEED2
Technique: SWITCH

Scene: GROUND1
Technique: LINEAR

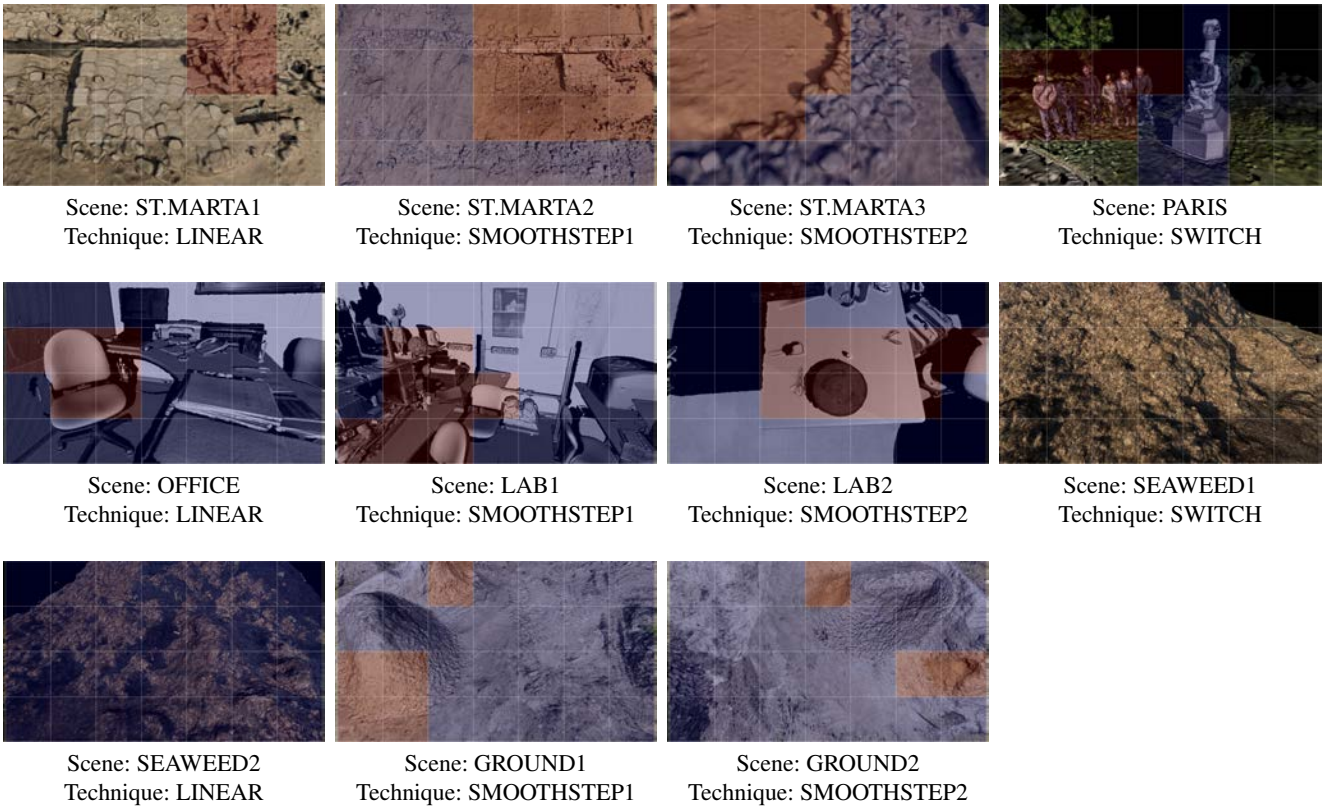
Scene: GROUND2
Technique: SMOOTHSTEP1

Figure 23: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.566(0.177)	22	0.874(0.081)	44	0.205	17
LINEAR	0.638(0.115)	16	0.938(0.033)	50	0.214	18
SMOOTHSTEP1	0.657(0.133)	44	0.971(0.008)	30	0.063	5
SMOOTHSTEP2	0.802(0.080)	12	0.572(0.164)	20	0.418	23

Table 20: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 2 - Session 1



Scene: ST.MARTA1
Technique: LINEAR

Scene: ST.MARTA2
Technique: SMOOTHSTEP1

Scene: ST.MARTA3
Technique: SMOOTHSTEP2

Scene: PARIS
Technique: SWITCH

Scene: OFFICE
Technique: LINEAR

Scene: LAB1
Technique: SMOOTHSTEP1

Scene: LAB2
Technique: SMOOTHSTEP2

Scene: SEAWEED1
Technique: SWITCH

Scene: SEAWEED2
Technique: LINEAR

Scene: GROUND1
Technique: SMOOTHSTEP1

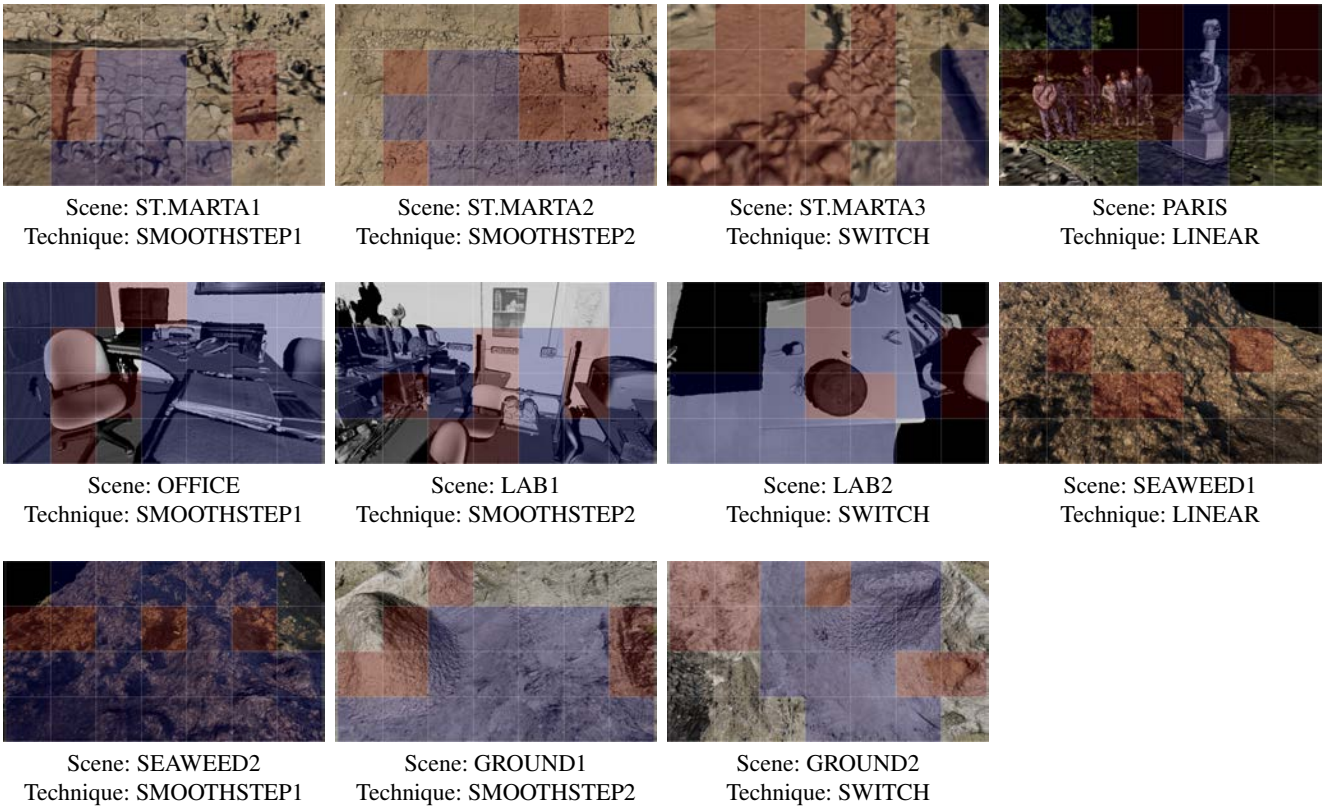
Scene: GROUND2
Technique: SMOOTHSTEP2

Figure 24: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	1.000(0.000)	7	0.911(0.029)	6	0.764	42
LINEAR	0.847(0.062)	9	0.921(0.053)	50	0.289	24
SMOOTHSTEP1	0.839(0.053)	25	0.976(0.017)	59	0.000	0
SMOOTHSTEP2	0.860(0.057)	24	0.961(0.024)	55	0.000	0

Table 21: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 3 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP1

Scene: ST.MARTA2
Technique: SMOOTHSTEP2

Scene: ST.MARTA3
Technique: SWITCH

Scene: PARIS
Technique: LINEAR

Scene: OFFICE
Technique: SMOOTHSTEP1

Scene: LAB1
Technique: SMOOTHSTEP2

Scene: LAB2
Technique: SWITCH

Scene: SEAWEED1
Technique: LINEAR

Scene: SEAWEED2
Technique: SMOOTHSTEP1

Scene: GROUND1
Technique: SMOOTHSTEP2

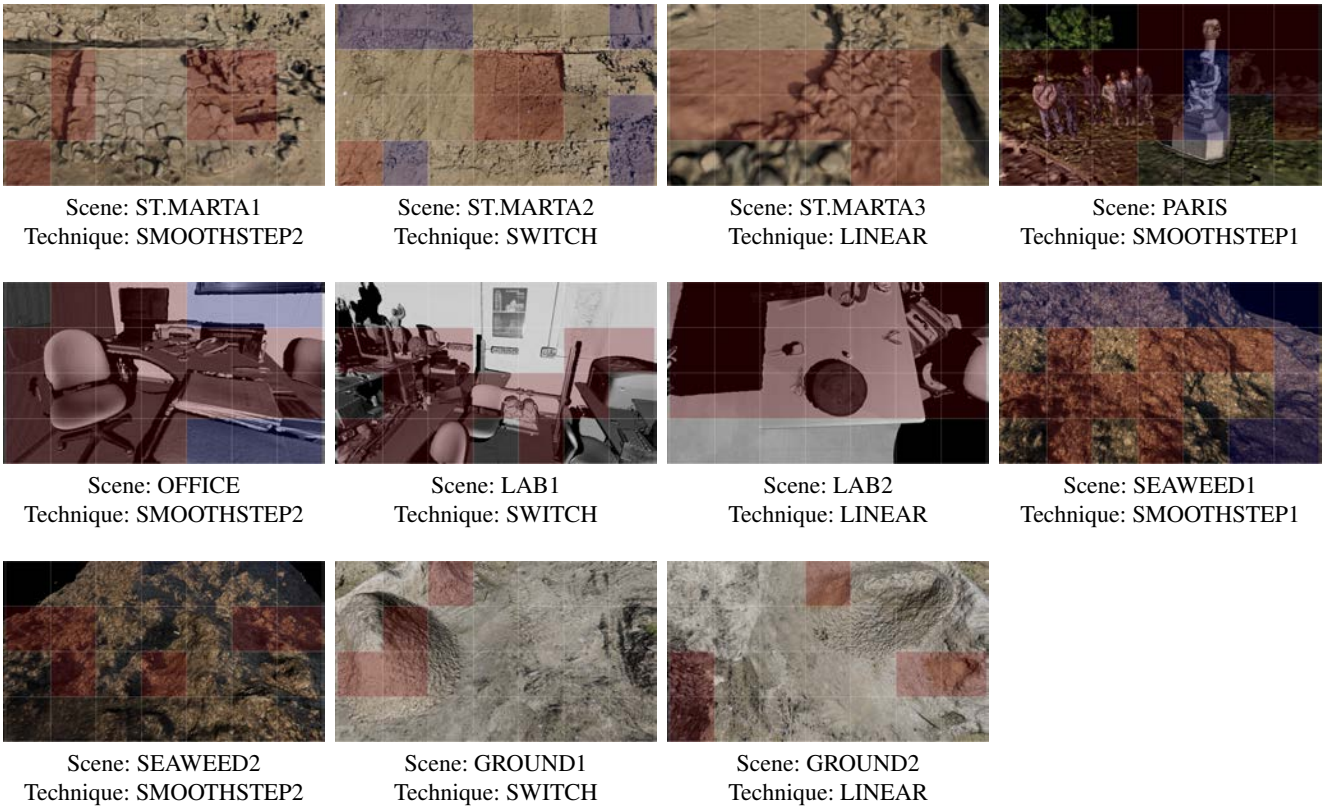
Scene: GROUND2
Technique: SWITCH

Figure 25: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.685(0.158)	30	1.000(0.000)	31	0.228	18
LINEAR	0.892(0.058)	17	0.782(0.089)	6	0.582	32
SMOOTHSTEP1	0.735(0.105)	14	0.941(0.045)	49	0.241	20
SMOOTHSTEP2	0.639(0.133)	21	0.916(0.058)	38	0.298	25

Table 22: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 4 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP2

Scene: ST.MARTA2
Technique: SWITCH

Scene: ST.MARTA3
Technique: LINEAR

Scene: PARIS
Technique: SMOOTHSTEP1

Scene: OFFICE
Technique: SMOOTHSTEP2

Scene: LAB1
Technique: SWITCH

Scene: LAB2
Technique: LINEAR

Scene: SEAWEED1
Technique: SMOOTHSTEP1

Scene: SEAWEED2
Technique: SMOOTHSTEP2

Scene: GROUND1
Technique: SWITCH

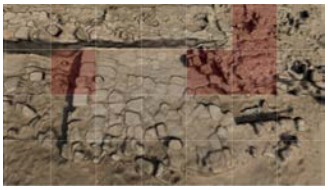
Scene: GROUND2
Technique: LINEAR

Figure 26: *Final data of the subject in the first user study session.*

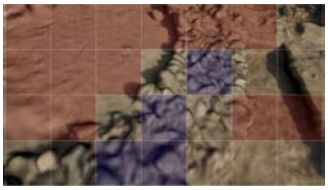
	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.673(0.096)	23	0.835(0.068)	7	0.643	54
LINEAR	0.692(0.125)	37	0(0)	0	0.532	42
SMOOTHSTEP1	0.748(0.124)	28	0.994(0.000)	12	0.273	15
SMOOTHSTEP2	0.660(0.124)	34	1.000(0.000)	6	0.518	43

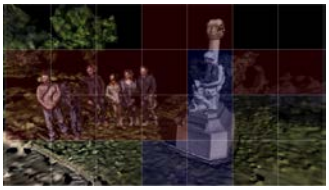
Table 23: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 5 - Session 1


Scene: ST.MARTA1
Technique: SWITCH


Scene: ST.MARTA2
Technique: LINEAR


Scene: ST.MARTA3
Technique: SMOOTHSTEP1

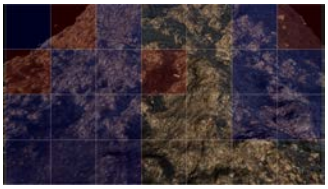

Scene: PARIS
Technique: SMOOTHSTEP2

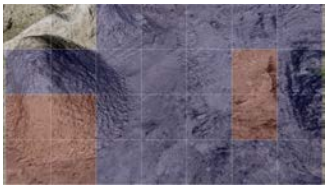

Scene: OFFICE
Technique: SWITCH


Scene: LAB1
Technique: LINEAR


Scene: LAB2
Technique: SMOOTHSTEP1


Scene: SEAWEED1
Technique: SMOOTHSTEP2


Scene: SEAWEED2
Technique: SWITCH


Scene: GROUND1
Technique: LINEAR

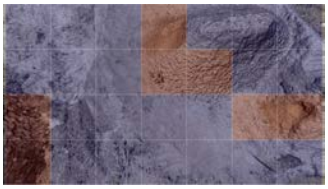

Scene: GROUND2
Technique: SMOOTHSTEP1

Figure 27: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.773(0.093)	18	0.943(0.044)	29	0.434	36
LINEAR	0.701(0.108)	22	1.000(0.000)	33	0.345	29
SMOOTHSTEP1	0.728(0.112)	33	0.988(0.004)	33	0.165	13
SMOOTHSTEP2	0.698(0.147)	22	0.986(0.001)	5	0.509	28

Table 24: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 6 - Session 1

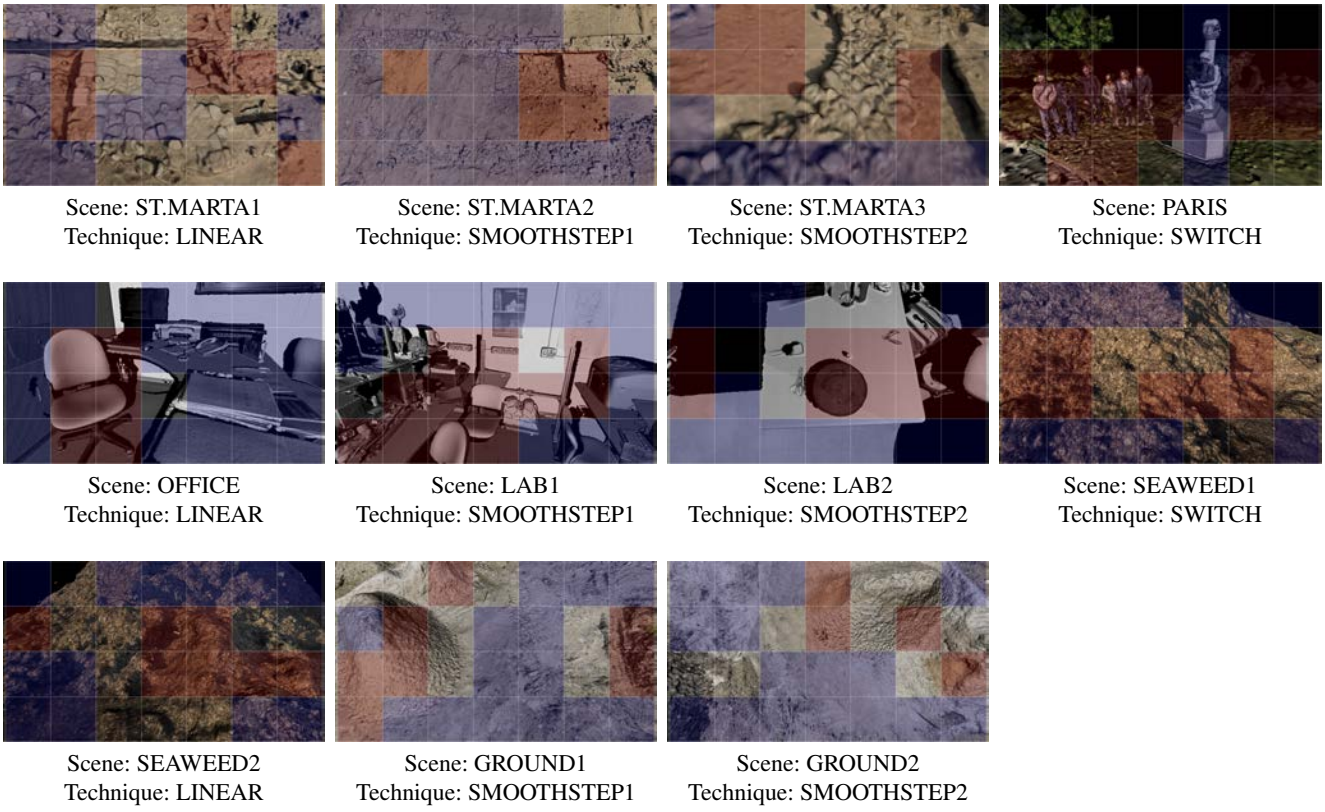
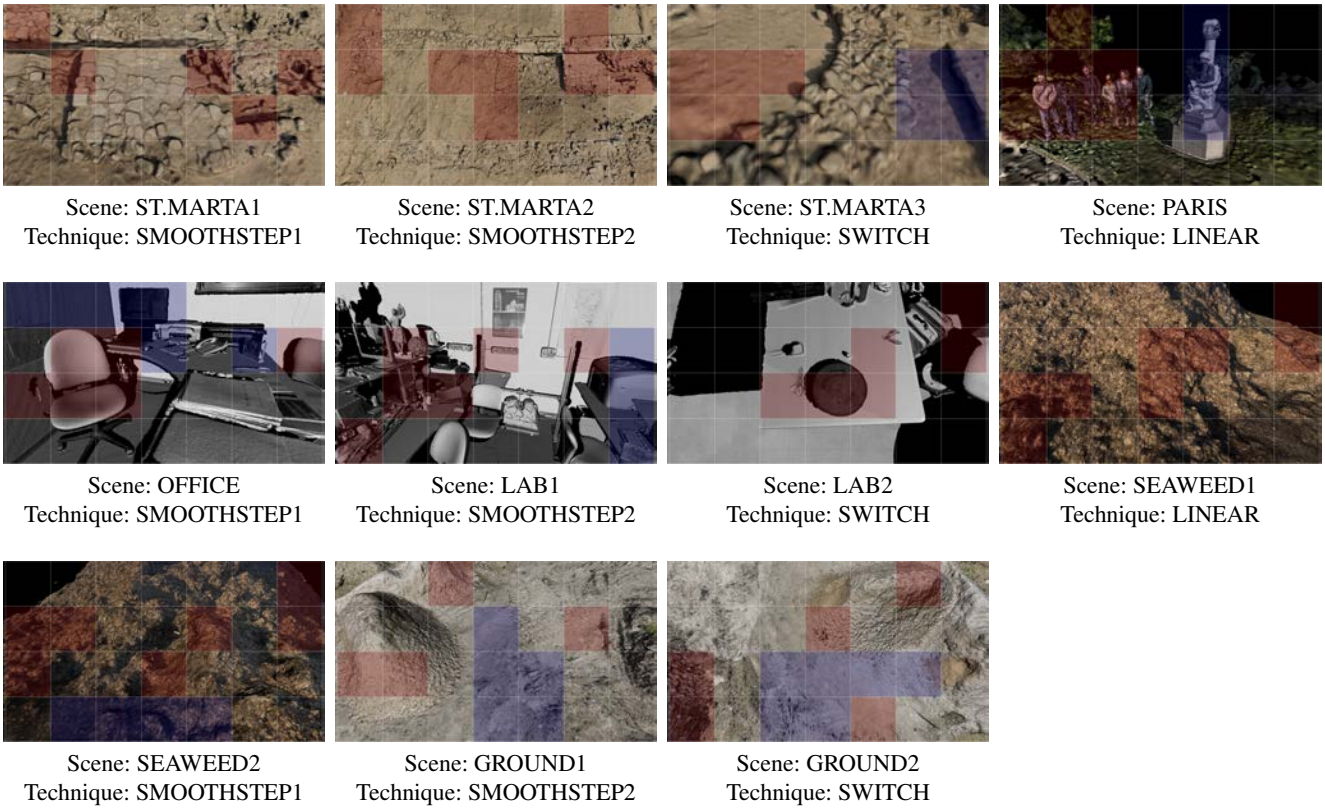


Figure 28: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.707(0.135)	22	0.962(0.014)	14	0.345	19
LINEAR	0.677(0.151)	19	0.879(0.091)	42	0.265	22
SMOOTHSTEP1	0.649(0.108)	24	0.919(0.054)	47	0.155	13
SMOOTHSTEP2	0.739(0.112)	20	0.950(0.032)	34	0.316	25

Table 25: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 7 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP1

Scene: ST.MARTA2
Technique: SMOOTHSTEP2

Scene: ST.MARTA3
Technique: SWITCH

Scene: PARIS
Technique: LINEAR

Scene: OFFICE
Technique: SMOOTHSTEP1

Scene: LAB1
Technique: SMOOTHSTEP2

Scene: LAB2
Technique: SWITCH

Scene: SEAWEED1
Technique: LINEAR

Scene: SEAWEED2
Technique: SMOOTHSTEP1

Scene: GROUND1
Technique: SMOOTHSTEP2

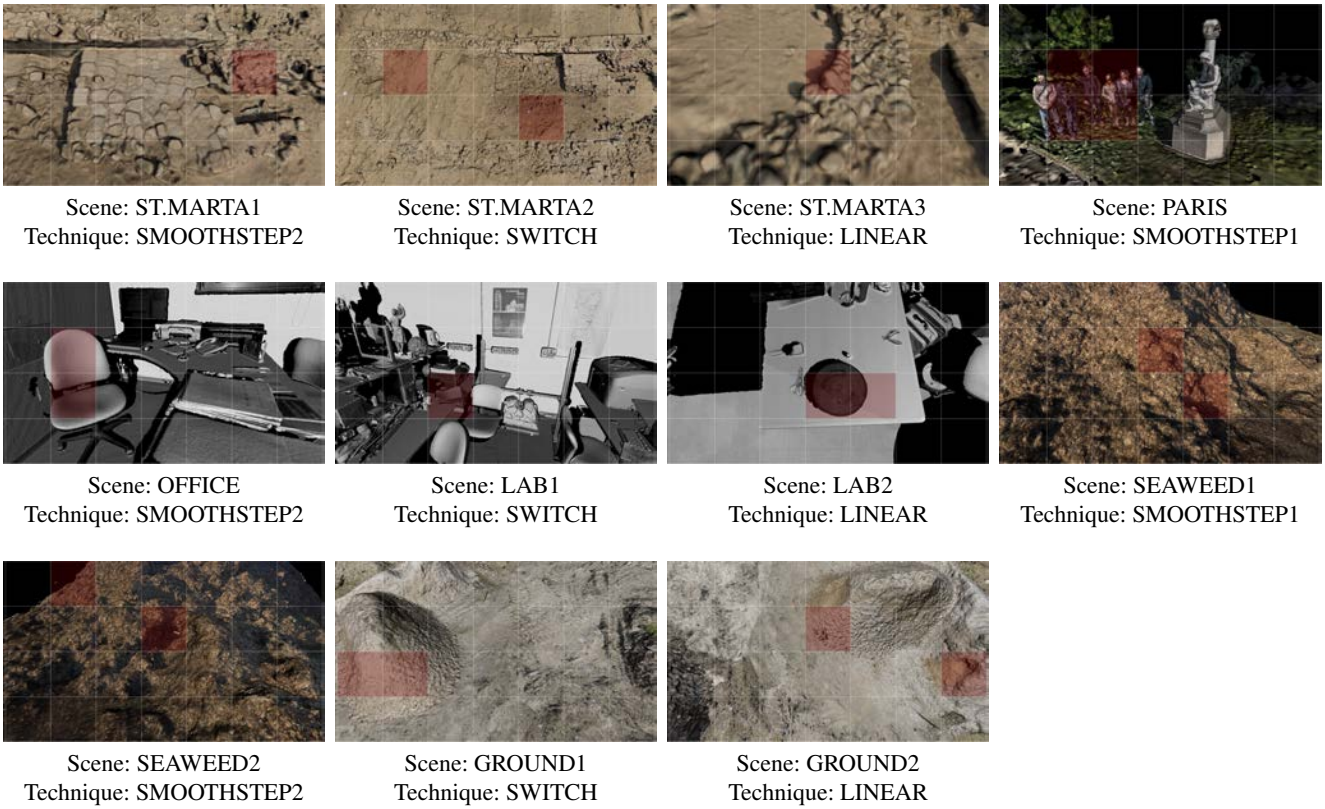
Scene: GROUND2
Technique: SWITCH

Figure 29: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.756(0.141)	16	1.000(0.000)	10	0.671	53
LINEAR	0.704(0.153)	14	0.822(0.042)	3	0.691	38
SMOOTHSTEP1	0.613(0.095)	18	1.000(0.000)	10	0.663	55
SMOOTHSTEP2	0.694(0.105)	18	1.000(0.000)	8	0.690	58

Table 26: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 8 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP2

Scene: ST.MARTA2
Technique: SWITCH

Scene: ST.MARTA3
Technique: LINEAR

Scene: PARIS
Technique: SMOOTHSTEP1

Scene: OFFICE
Technique: SMOOTHSTEP2

Scene: LAB1
Technique: SWITCH

Scene: LAB2
Technique: LINEAR

Scene: SEAWEED1
Technique: SMOOTHSTEP1

Scene: SEAWEED2
Technique: SMOOTHSTEP2

Scene: GROUND1
Technique: SWITCH

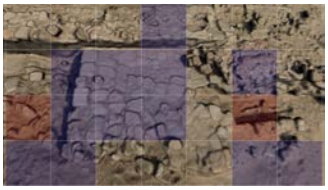
Scene: GROUND2
Technique: LINEAR

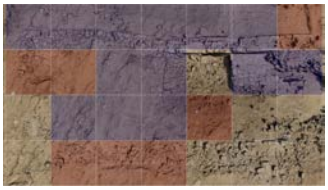
Figure 30: *Final data of the subject in the first user study session.*

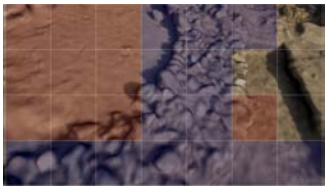
	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.874(0.012)	5	0(0)	0	0.940	79
LINEAR	0.842(0.099)	5	0(0)	0	0.937	74
SMOOTHSTEP1	0.744(0.136)	6	0(0)	0	0.891	49
SMOOTHSTEP2	0.678(0.156)	5	0(0)	0	0.940	78

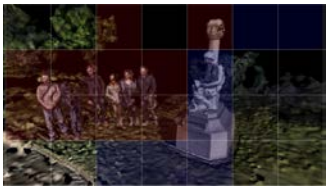
Table 27: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 9 - Session 1


Scene: ST.MARTA1
Technique: SWITCH

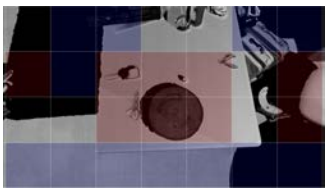

Scene: ST.MARTA2
Technique: LINEAR

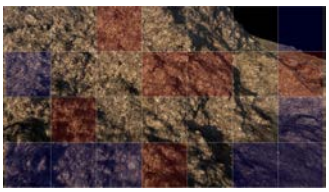

Scene: ST.MARTA3
Technique: SMOOTHSTEP1

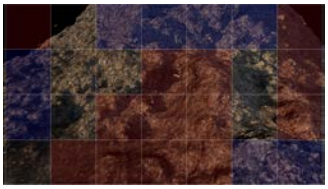

Scene: PARIS
Technique: SMOOTHSTEP2

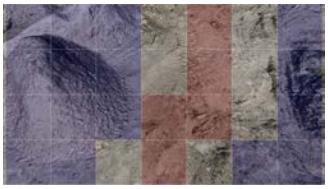

Scene: OFFICE
Technique: SWITCH


Scene: LAB1
Technique: LINEAR


Scene: LAB2
Technique: SMOOTHSTEP1


Scene: SEAWEED1
Technique: SMOOTHSTEP2


Scene: SEAWEED2
Technique: SWITCH


Scene: GROUND1
Technique: LINEAR

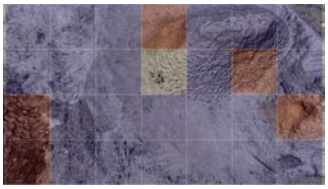

Scene: GROUND2
Technique: SMOOTHSTEP1

Figure 31: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.502(0.176)	22	0.908(0.058)	37	0.289	24
LINEAR	0.515(0.161)	23	0.913(0.056)	44	0.202	17
SMOOTHSTEP1	0.825(0.084)	23	0.974(0.013)	44	0.152	12
SMOOTHSTEP2	0.679(0.151)	16	0.852(0.121)	14	0.455	25

Table 28: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 10 - Session 1

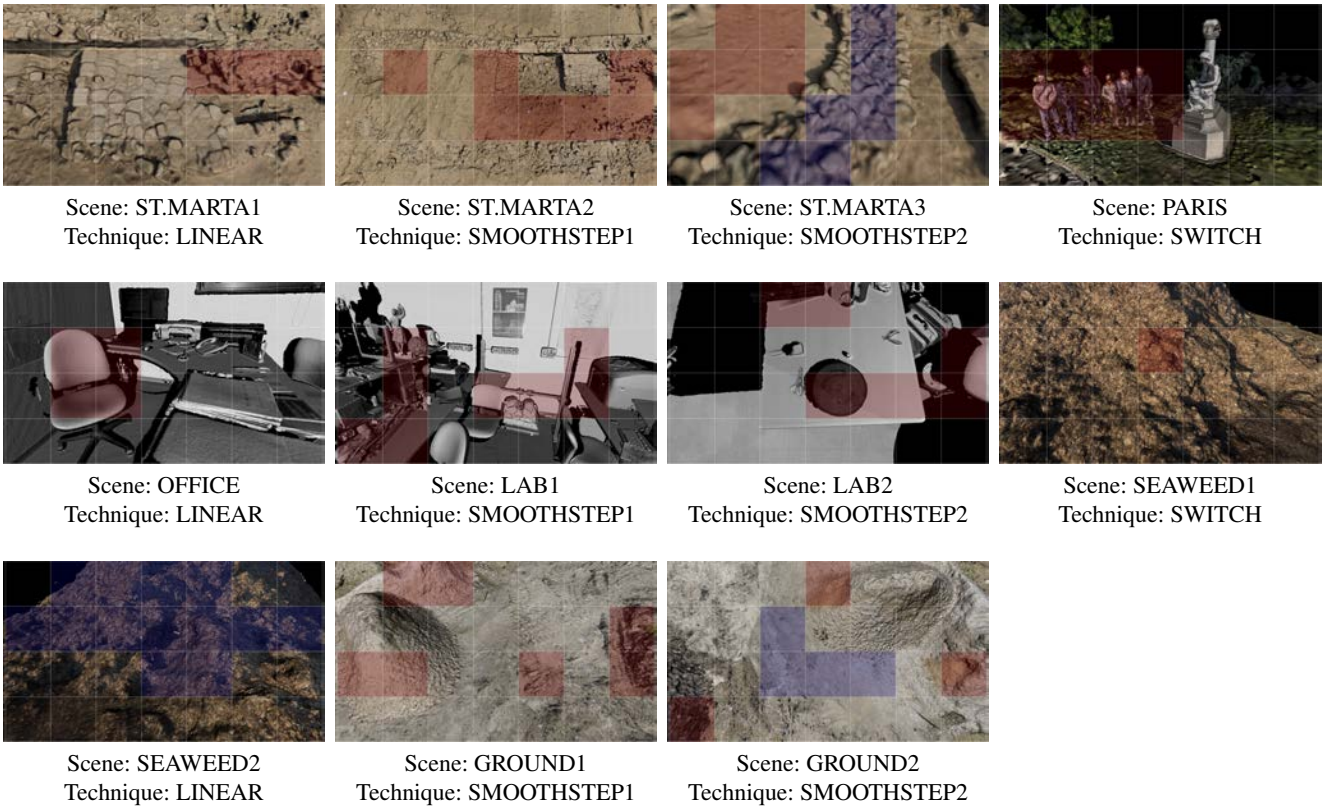
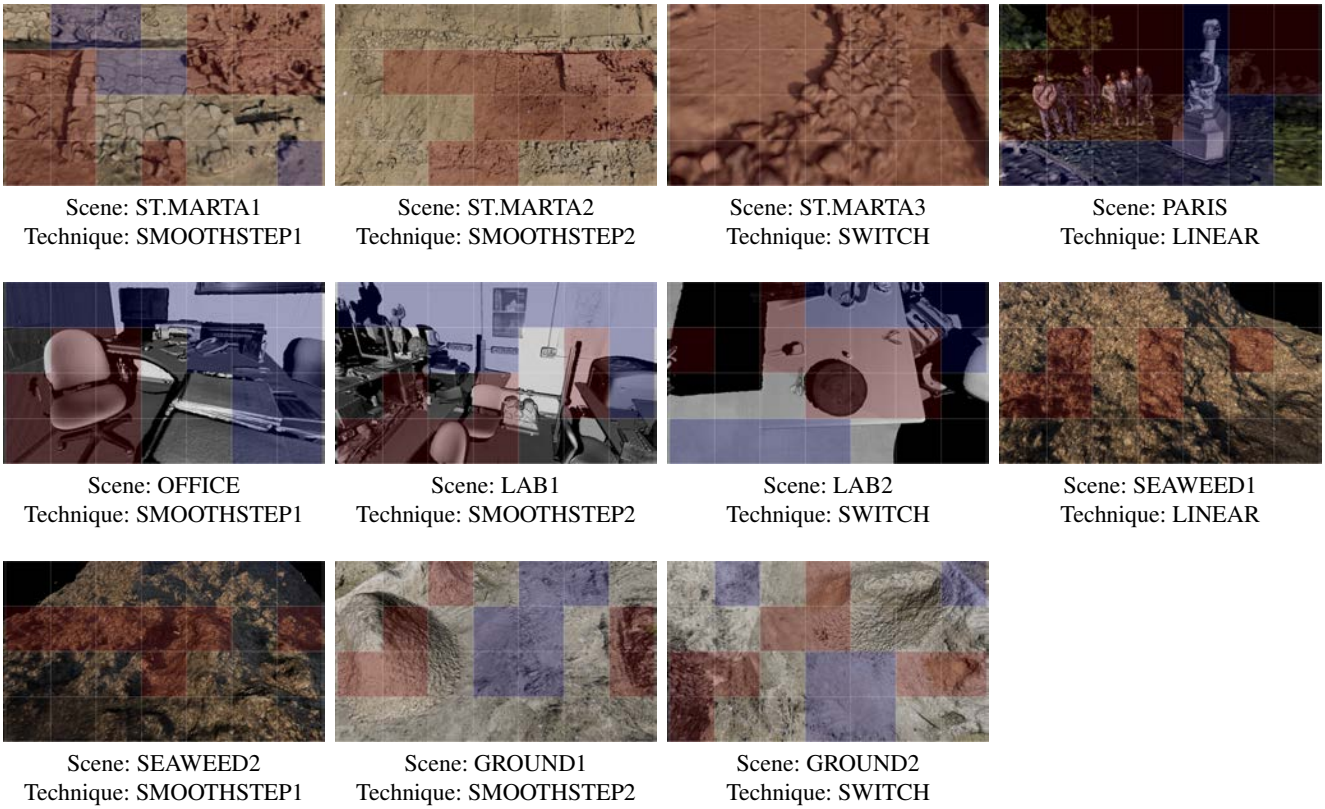


Figure 32: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.886(0.049)	9	0(0)	0	0.836	46
LINEAR	0.932(0.028)	7	1.000(0.000)	13	0.759	63
SMOOTHSTEP1	0.661(0.135)	22	0(0)	0	0.738	62
SMOOTHSTEP2	0.950(0.013)	16	1.000(0.000)	10	0.671	53

Table 29: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 11 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP1

Scene: ST.MARTA2
Technique: SMOOTHSTEP2

Scene: ST.MARTA3
Technique: SWITCH

Scene: PARIS
Technique: LINEAR

Scene: OFFICE
Technique: SMOOTHSTEP1

Scene: LAB1
Technique: SMOOTHSTEP2

Scene: LAB2
Technique: SWITCH

Scene: SEAWEED1
Technique: LINEAR

Scene: SEAWEED2
Technique: SMOOTHSTEP1

Scene: GROUND1
Technique: SMOOTHSTEP2

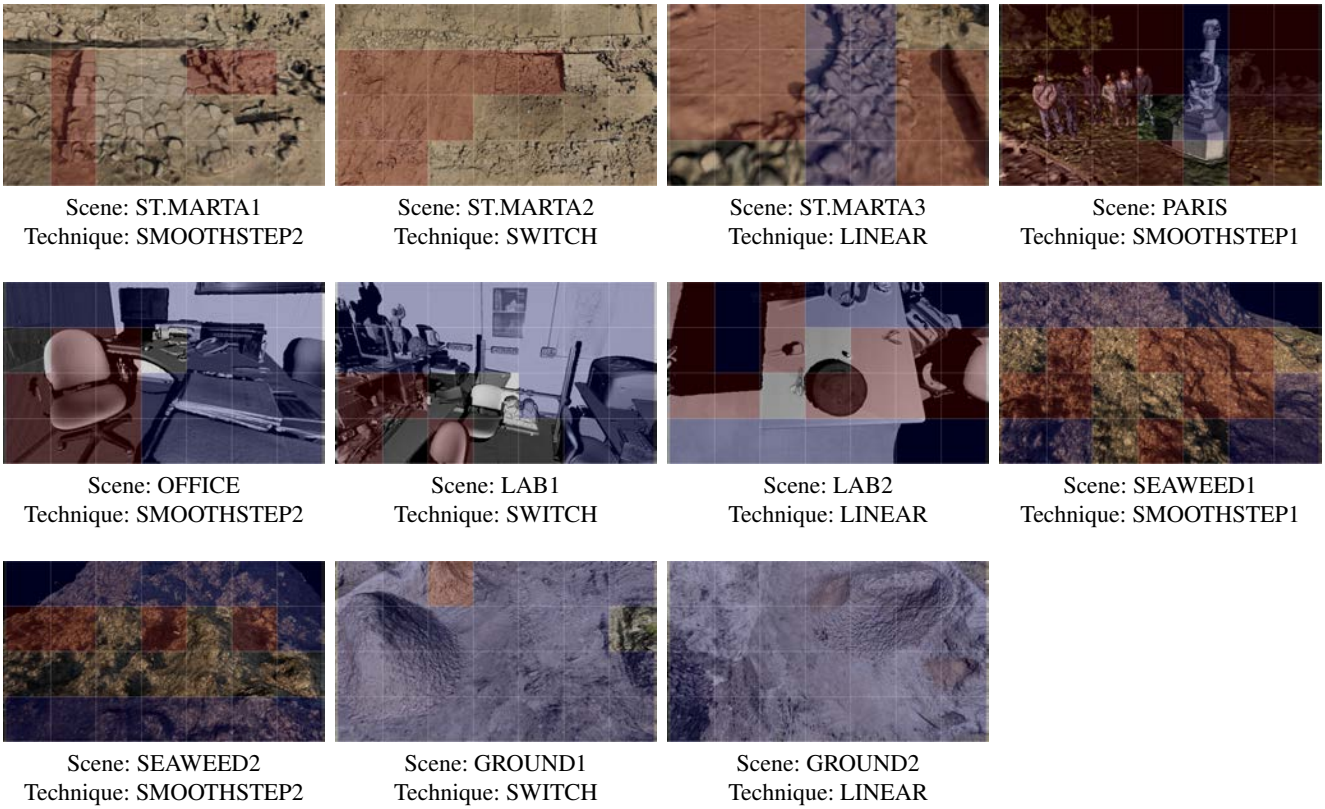
Scene: GROUND2
Technique: SWITCH

Figure 33: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.627(0.147)	44	0.892(0.058)	15	0.253	20
LINEAR	0.896(0.040)	21	0.835(0.057)	10	0.436	24
SMOOTHSTEP1	0.755(0.083)	28	0.933(0.039)	19	0.434	36
SMOOTHSTEP2	0.679(0.135)	26	1.000(0.000)	17	0.488	41

Table 30: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 12 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP2

Scene: ST.MARTA2
Technique: SWITCH

Scene: ST.MARTA3
Technique: LINEAR

Scene: PARIS
Technique: SMOOTHSTEP1

Scene: OFFICE
Technique: SMOOTHSTEP2

Scene: LAB1
Technique: SWITCH

Scene: LAB2
Technique: LINEAR

Scene: SEAWEED1
Technique: SMOOTHSTEP1

Scene: SEAWEED2
Technique: SMOOTHSTEP2

Scene: GROUND1
Technique: SWITCH

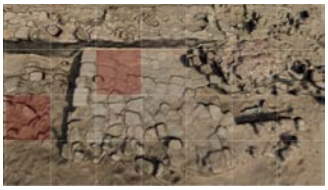
Scene: GROUND2
Technique: LINEAR

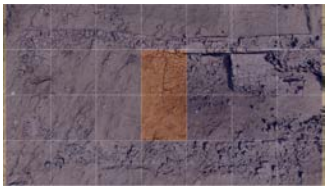
Figure 34: *Final data of the subject in the first user study session.*

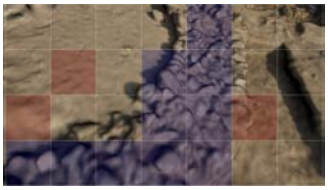
	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.689(0.118)	15	1.000(0.000)	45	0.286	24
LINEAR	0.731(0.128)	27	0.956(0.018)	45	0.089	7
SMOOTHSTEP1	0.677(0.164)	32	0.962(0.014)	14	0.164	9
SMOOTHSTEP2	0.785(0.096)	17	0.939(0.043)	32	0.410	34

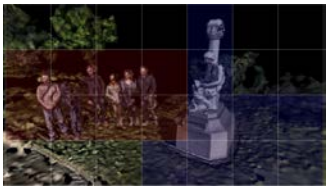
Table 31: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 13 - Session 1


Scene: ST.MARTA1
Technique: SWITCH


Scene: ST.MARTA2
Technique: LINEAR

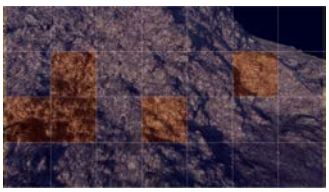

Scene: ST.MARTA3
Technique: SMOOTHSTEP1

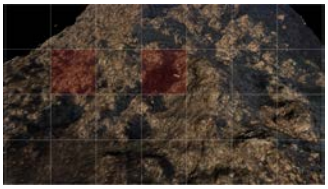

Scene: PARIS
Technique: SMOOTHSTEP2

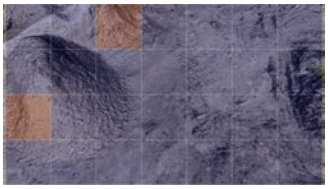

Scene: OFFICE
Technique: SWITCH


Scene: LAB1
Technique: LINEAR


Scene: LAB2
Technique: SMOOTHSTEP1


Scene: SEAWEED1
Technique: SMOOTHSTEP2


Scene: SEAWEED2
Technique: SWITCH


Scene: GROUND1
Technique: LINEAR

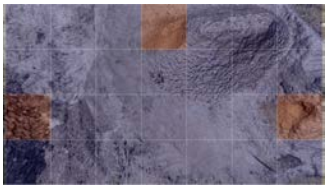
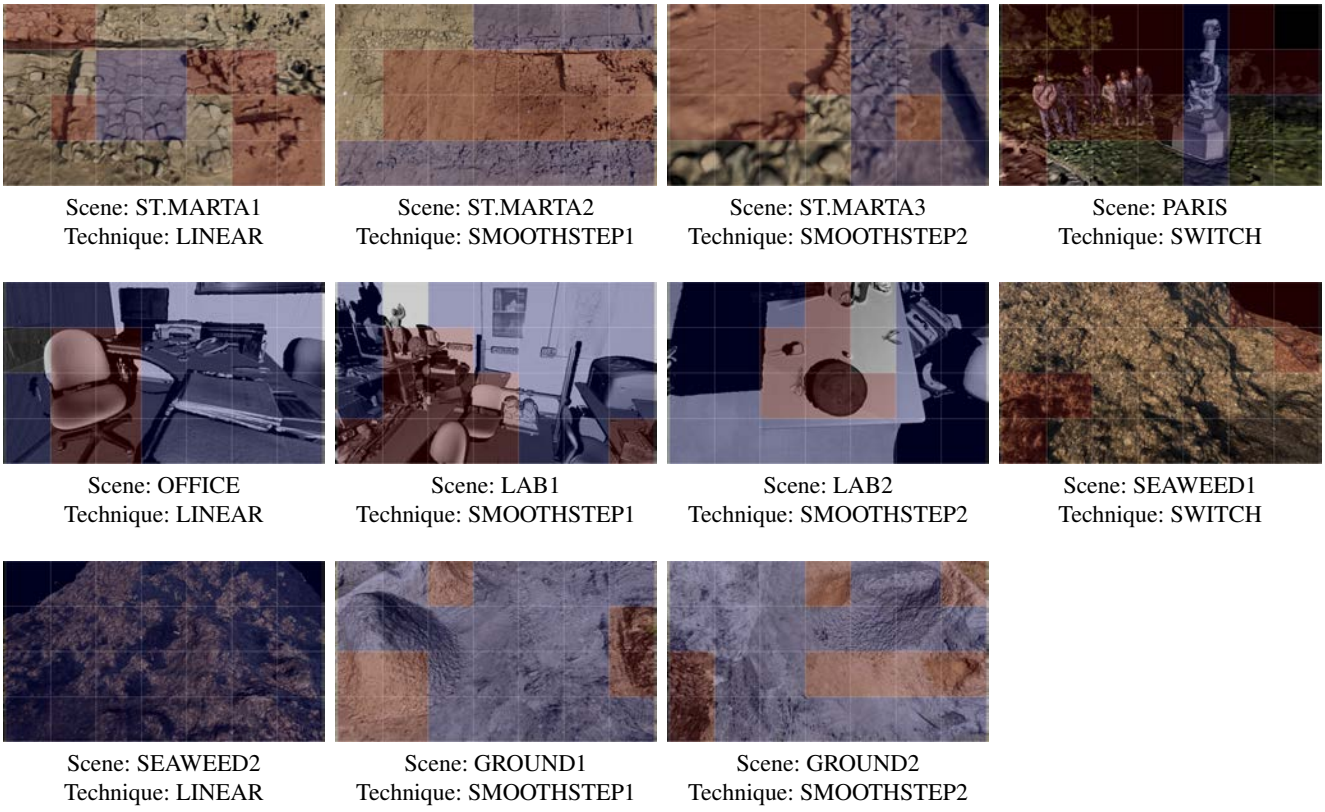

Scene: GROUND2
Technique: SMOOTHSTEP1

Figure 35: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.735(0.117)	12	0.855(0.097)	20	0.614	51
LINEAR	0.870(0.033)	11	0.924(0.047)	73	0.000	0
SMOOTHSTEP1	0.803(0.085)	14	0.984(0.006)	45	0.253	20
SMOOTHSTEP2	0.880(0.036)	13	0.983(0.007)	31	0.200	11

Table 32: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 14 - Session 1



Scene: ST.MARTA1
Technique: LINEAR

Scene: ST.MARTA2
Technique: SMOOTHSTEP1

Scene: ST.MARTA3
Technique: SMOOTHSTEP2

Scene: PARIS
Technique: SWITCH

Scene: OFFICE
Technique: LINEAR

Scene: LAB1
Technique: SMOOTHSTEP1

Scene: LAB2
Technique: SMOOTHSTEP2

Scene: SEAWEED1
Technique: SWITCH

Scene: SEAWEED2
Technique: LINEAR

Scene: GROUND1
Technique: SMOOTHSTEP1

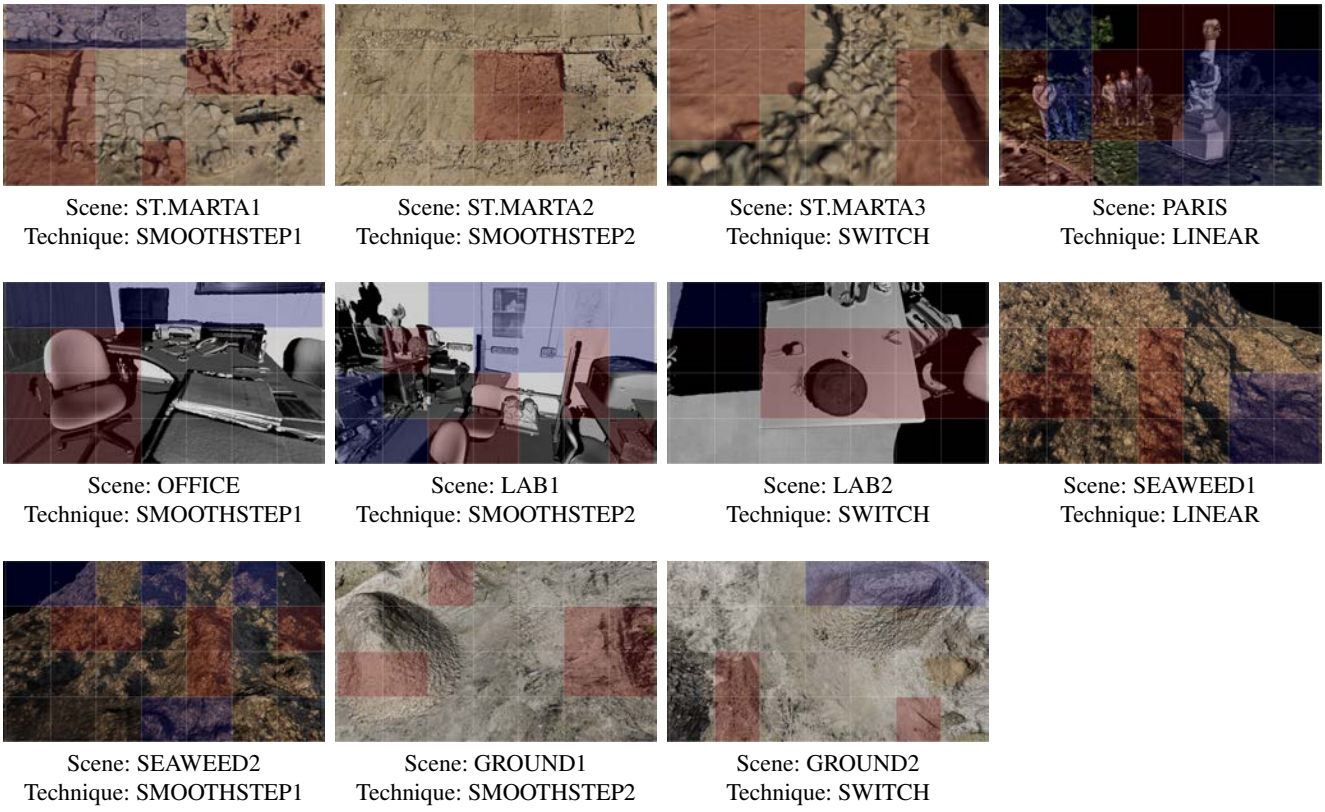
Scene: GROUND2
Technique: SMOOTHSTEP2

Figure 36: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.840(0.088)	21	0.867(0.037)	4	0.545	30
LINEAR	0.880(0.046)	15	0.944(0.042)	52	0.193	16
SMOOTHSTEP1	0.772(0.085)	29	0.975(0.013)	49	0.071	6
SMOOTHSTEP2	0.738(0.138)	26	0.948(0.039)	46	0.089	7

Table 33: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 15 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP1

Scene: ST.MARTA2
Technique: SMOOTHSTEP2

Scene: ST.MARTA3
Technique: SWITCH

Scene: PARIS
Technique: LINEAR

Scene: OFFICE
Technique: SMOOTHSTEP1

Scene: LAB1
Technique: SMOOTHSTEP2

Scene: LAB2
Technique: SWITCH

Scene: SEAWEED1
Technique: LINEAR

Scene: SEAWEED2
Technique: SMOOTHSTEP1

Scene: GROUND1
Technique: SMOOTHSTEP2

Scene: GROUND2
Technique: SWITCH

Figure 37: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.617(0.168)	27	0.987(0.001)	5	0.595	47
LINEAR	0.851(0.063)	17	0.735(0.138)	18	0.364	20
SMOOTHSTEP1	0.776(0.092)	25	1.000(0.000)	16	0.506	42
SMOOTHSTEP2	0.612(0.140)	18	0.968(0.010)	11	0.655	55

Table 34: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 16 - Session 1

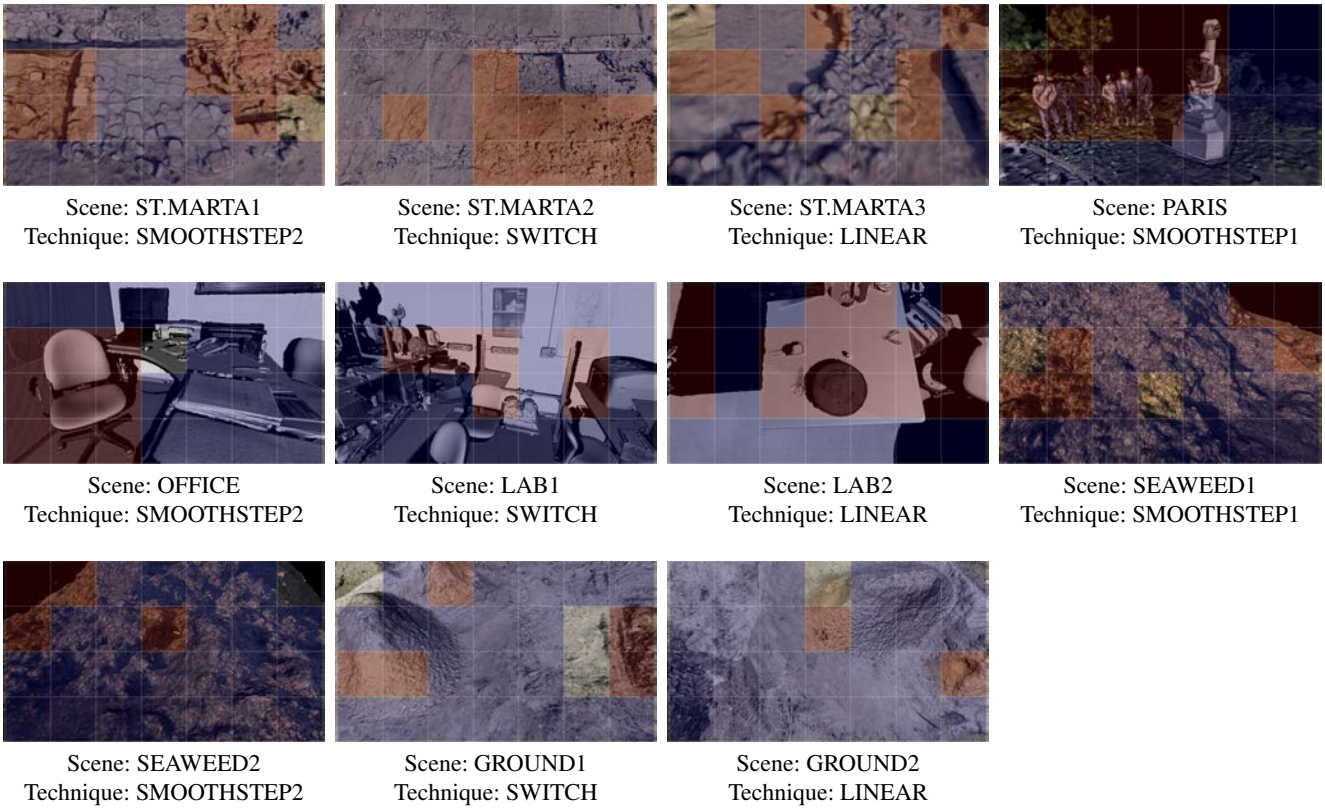
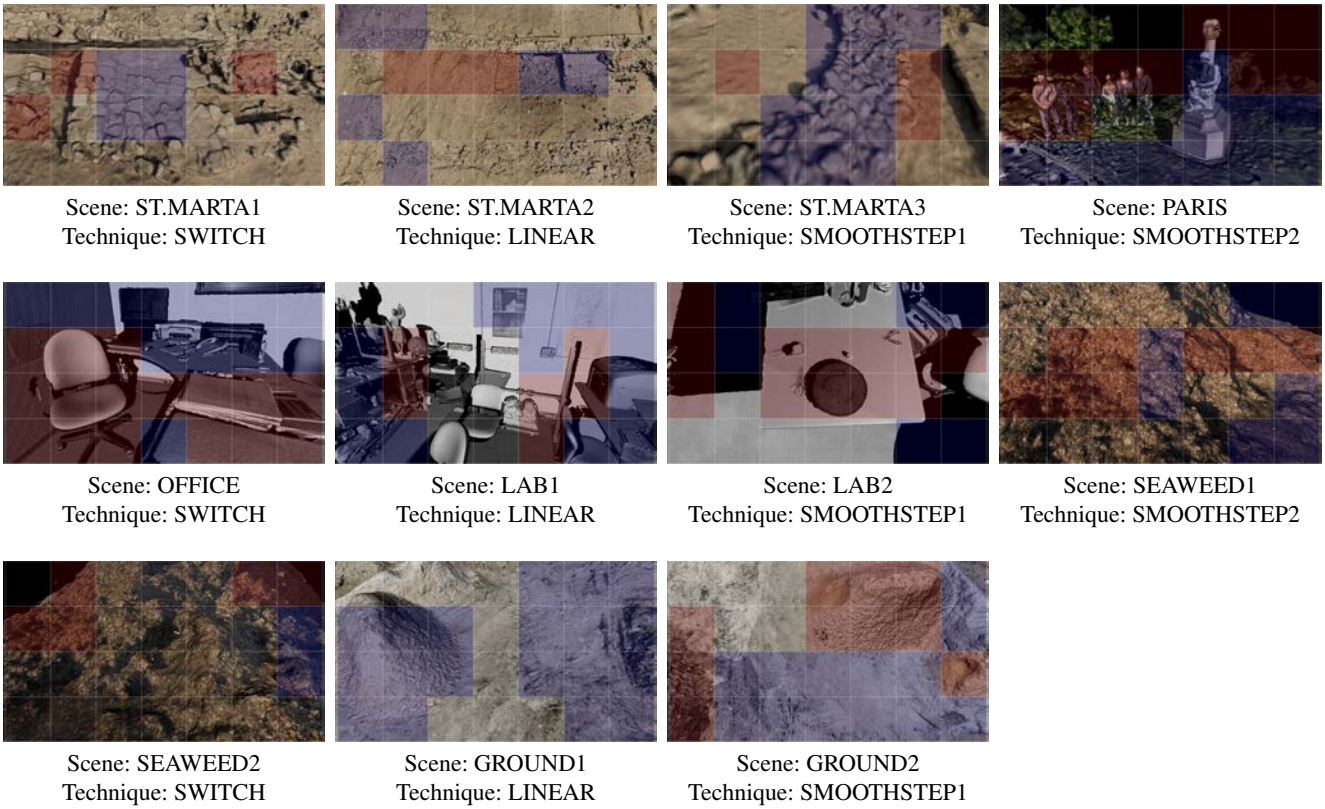


Figure 38: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.558(0.122)	21	0.920(0.043)	60	0.036	3
LINEAR	0.725(0.107)	24	0.897(0.087)	52	0.038	3
SMOOTHSTEP1	0.864(0.061)	18	0.864(0.092)	34	0.055	3
SMOOTHSTEP2	0.760(0.086)	22	0.929(0.048)	58	0.036	3

Table 35: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 17 - Session 1



Scene: ST.MARTA1
Technique: SWITCH

Scene: ST.MARTA2
Technique: LINEAR

Scene: ST.MARTA3
Technique: SMOOTHSTEP1

Scene: PARIS
Technique: SMOOTHSTEP2

Scene: OFFICE
Technique: SWITCH

Scene: LAB1
Technique: LINEAR

Scene: LAB2
Technique: SMOOTHSTEP1

Scene: SEAWEED1
Technique: SMOOTHSTEP2

Scene: SEAWEED2
Technique: SWITCH

Scene: GROUND1
Technique: LINEAR

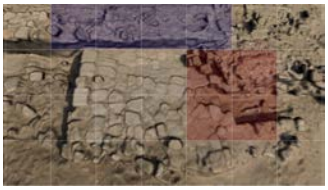
Scene: GROUND2
Technique: SMOOTHSTEP1

Figure 39: *Final data of the subject in the first user study session.*

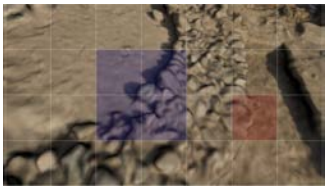
	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.694(0.132)	24	1.000(0.000)	18	0.494	41
LINEAR	0.700(0.065)	9	0.972(0.016)	38	0.440	37
SMOOTHSTEP1	0.571(0.133)	24	0.934(0.036)	26	0.367	29
SMOOTHSTEP2	0.745(0.146)	19	0.930(0.032)	17	0.345	19

Table 36: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 18 - Session 1


Scene: ST.MARTA1
Technique: LINEAR

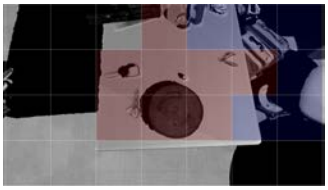

Scene: ST.MARTA2
Technique: SMOOTHSTEP1

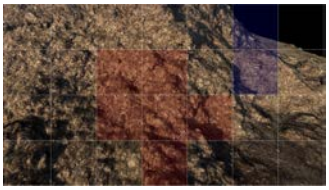

Scene: ST.MARTA3
Technique: SMOOTHSTEP2

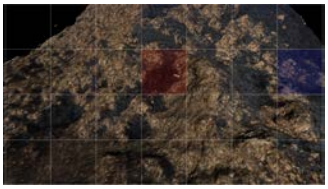

Scene: PARIS
Technique: SWITCH

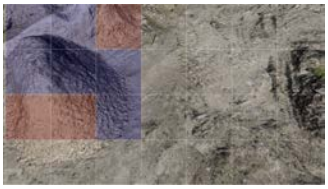

Scene: OFFICE
Technique: LINEAR


Scene: LAB1
Technique: SMOOTHSTEP1


Scene: LAB2
Technique: SMOOTHSTEP2


Scene: SEAWEED1
Technique: SWITCH


Scene: SEAWEED2
Technique: LINEAR


Scene: GROUND1
Technique: SMOOTHSTEP1

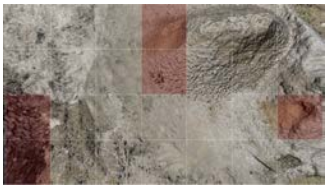
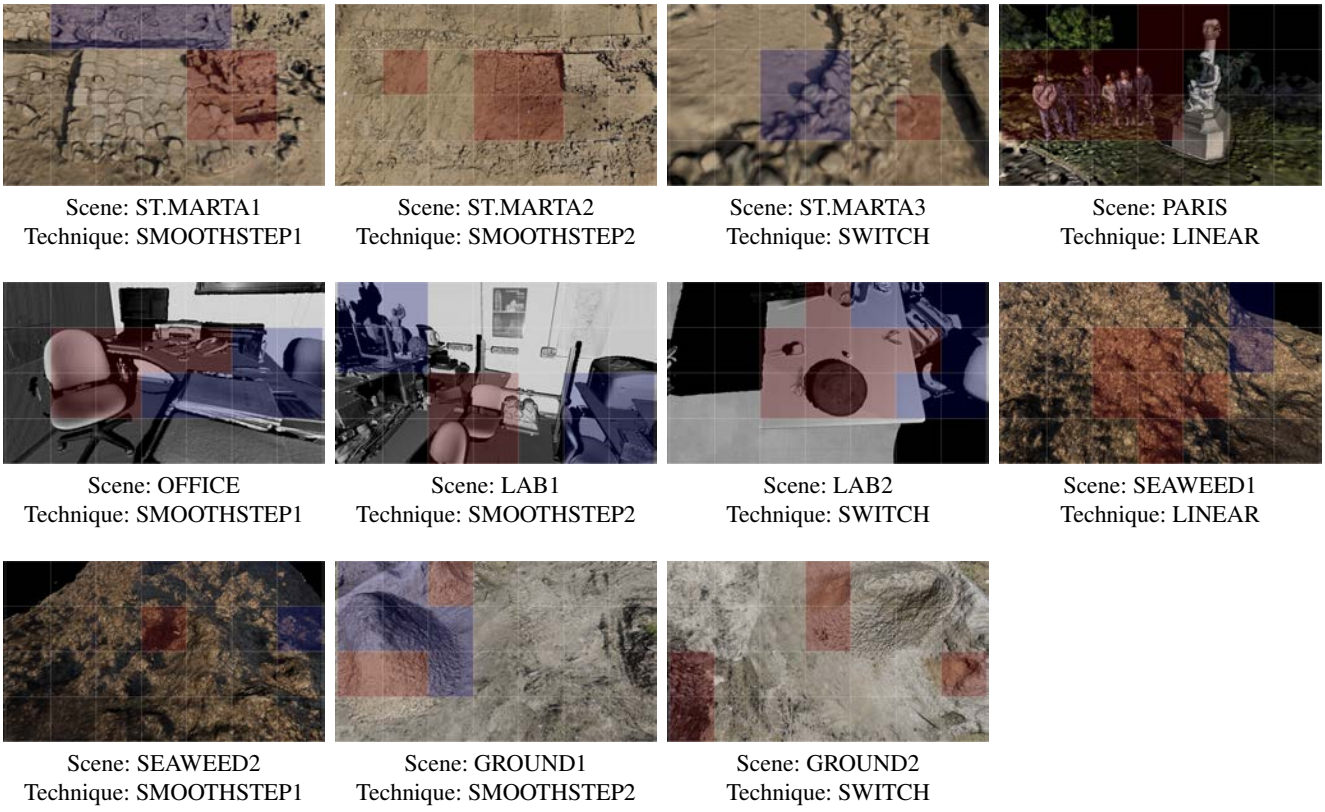

Scene: GROUND2
Technique: SMOOTHSTEP2

Figure 40: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.711(0.149)	16	1.000(0.000)	2	0.673	37
LINEAR	0.736(0.107)	11	0.821(0.103)	11	0.735	61
SMOOTHSTEP1	0.883(0.024)	12	1.000(0.000)	14	0.690	58
SMOOTHSTEP2	0.685(0.096)	14	0.608(0.182)	10	0.696	55

Table 37: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 19 - Session 1



Scene: ST.MARTA1
Technique: SMOOTHSTEP1

Scene: ST.MARTA2
Technique: SMOOTHSTEP2

Scene: ST.MARTA3
Technique: SWITCH

Scene: PARIS
Technique: LINEAR

Scene: OFFICE
Technique: SMOOTHSTEP1

Scene: LAB1
Technique: SMOOTHSTEP2

Scene: LAB2
Technique: SWITCH

Scene: SEAWEED1
Technique: LINEAR

Scene: SEAWEED2
Technique: SMOOTHSTEP1

Scene: GROUND1
Technique: SMOOTHSTEP2

Scene: GROUND2
Technique: SWITCH

Figure 41: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.626(0.129)	19	0.872(0.079)	26	0.430	34
LINEAR	0.909(0.039)	12	0.878(0.078)	33	0.182	10
SMOOTHSTEP1	0.659(0.090)	16	0.897(0.068)	39	0.337	28
SMOOTHSTEP2	0.599(0.194)	19	0.941(0.028)	32	0.393	33

Table 38: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 20 - Session 1

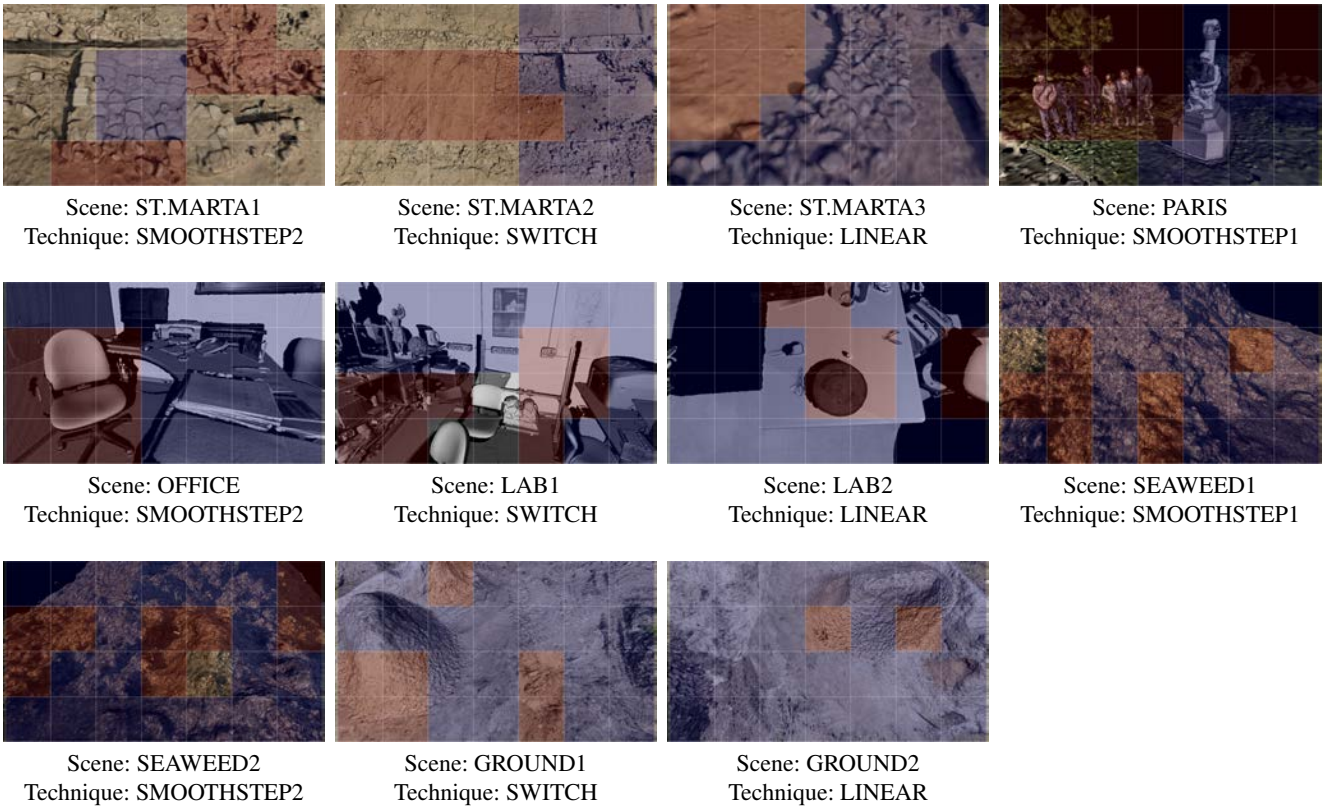
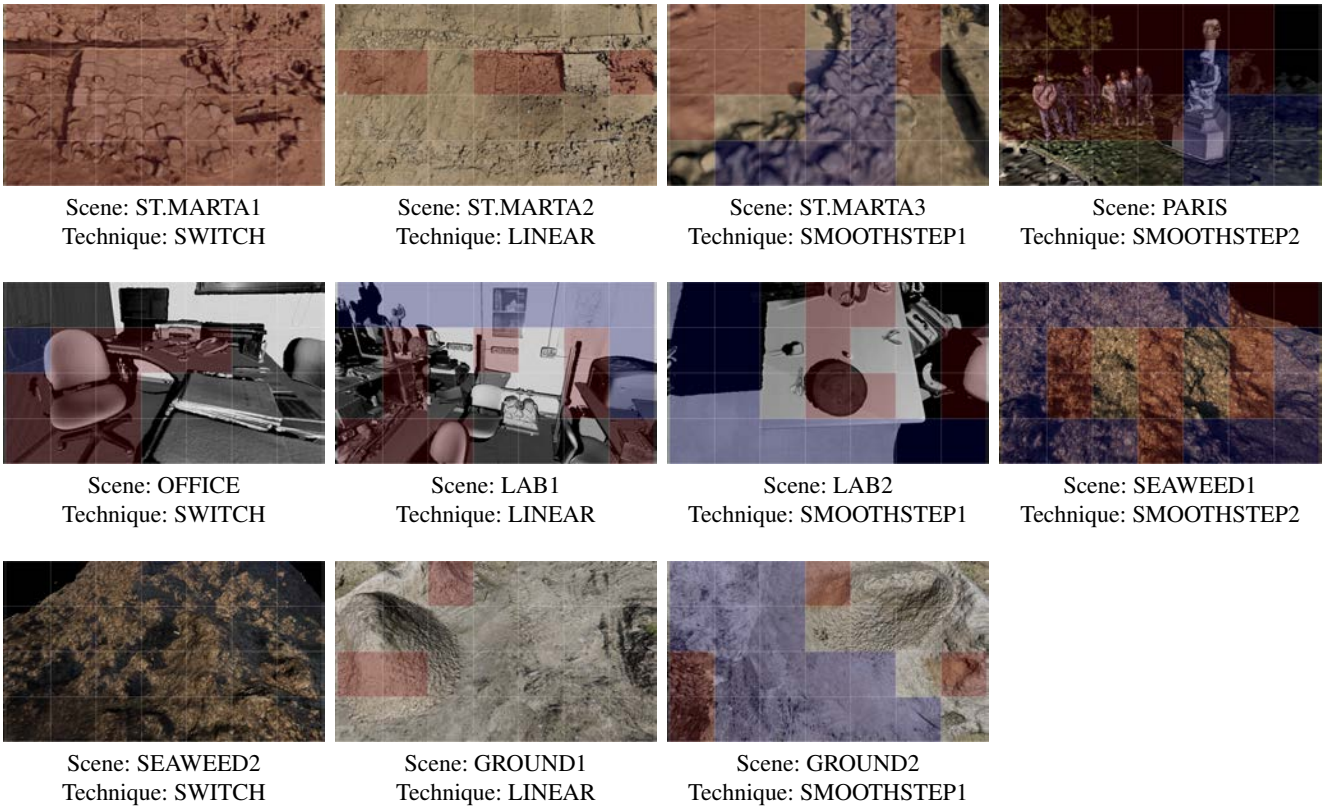


Figure 42: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.628(0.116)	26	0.933(0.034)	47	0.131	11
LINEAR	0.881(0.072)	18	0.961(0.019)	61	0.000	0
SMOOTHSTEP1	0.858(0.074)	23	0.981(0.008)	28	0.073	4
SMOOTHSTEP2	0.691(0.086)	25	0.952(0.034)	41	0.205	17

Table 39: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

Subject 21 - Session 1



Scene: ST.MARTA1
Technique: SWITCH

Scene: ST.MARTA2
Technique: LINEAR

Scene: ST.MARTA3
Technique: SMOOTHSTEP1

Scene: PARIS
Technique: SMOOTHSTEP2

Scene: OFFICE
Technique: SWITCH

Scene: LAB1
Technique: LINEAR

Scene: LAB2
Technique: SMOOTHSTEP1

Scene: SEAWEED1
Technique: SMOOTHSTEP2

Scene: SEAWEED2
Technique: SWITCH

Scene: GROUND1
Technique: LINEAR

Scene: GROUND2
Technique: SMOOTHSTEP1

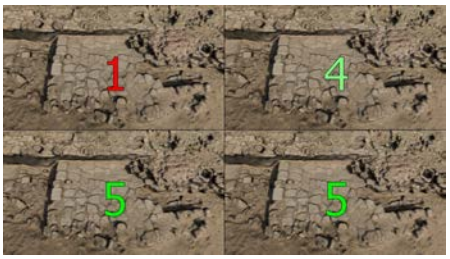
Figure 43: *Final data of the subject in the first user study session.*

	Change		No-Change		No-Answer	
	C	#Tiles	*NC*	#Tiles	*NA*	#Tiles
SWITCH	0.732(0.101)	38	1.000(0.000)	1	0.530	44
LINEAR	0.736(0.056)	17	1.000(0.000)	9	0.690	58
SMOOTHSTEP1	0.845(0.076)	20	0.998(0.000)	32	0.342	27
SMOOTHSTEP2	0.813(0.084)	23	0.997(0.000)	22	0.182	10

Table 40: *Results of the subject in the first user study session. For each technique we show the rate of tiles correctly identified as "change" (C), "no-change" (NC) and the percentage of "no answered" tiles (NA) with the relative absolute number of tiles for each category (column #Tiles).*

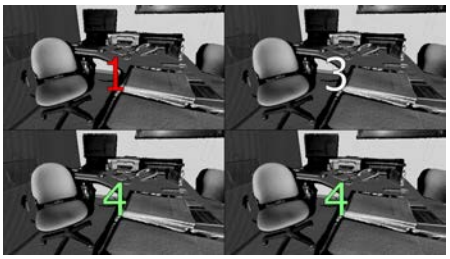
Preferred Techniques Provided in the Subjective Evaluation by Each User

Subject 1 - Session 2

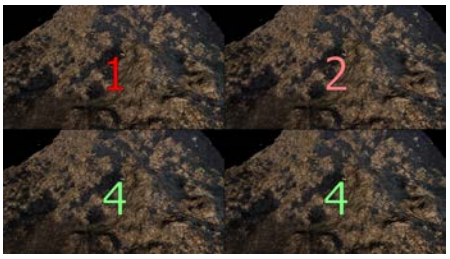


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

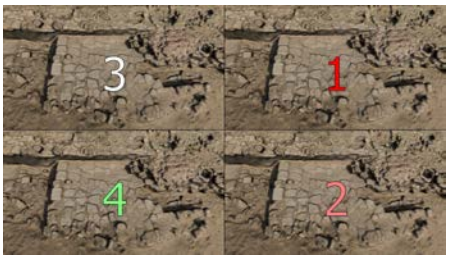
Scene: GROUND1

Figure 44: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.800(1.360)
LINEAR	3.000(0.800)
SMOOTHSTEP1	4.200(0.560)
SMOOTHSTEP2	4.400(0.240)

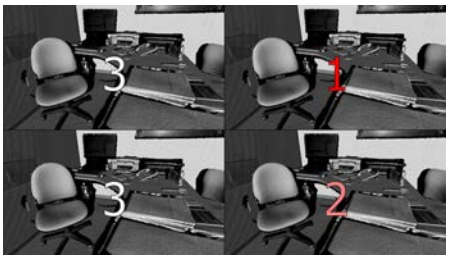
Table 41: *Final scores given by the subject to the techniques.*

Subject 2 - Session 2

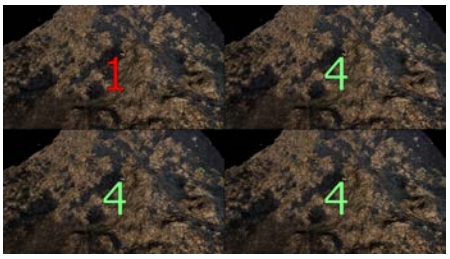


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

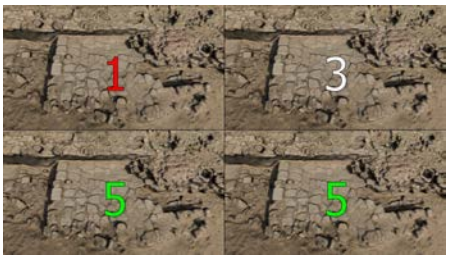
Scene: GROUND1

Figure 45: *Final data of the subject in the second user study session.*

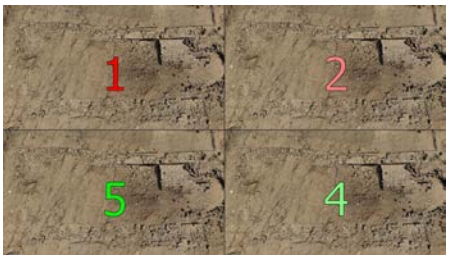
	Score
SWITCH	2.800(0.960)
LINEAR	1.600(1.440)
SMOOTHSTEP1	3.400(0.240)
SMOOTHSTEP2	2.800(0.560)

Table 42: *Final scores given by the subject to the techniques.*

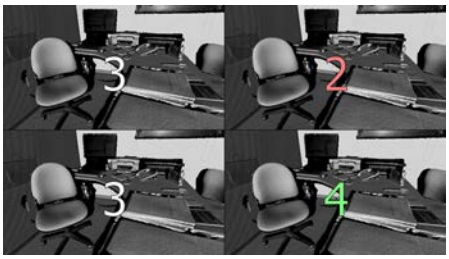
Subject 3 - Session 2



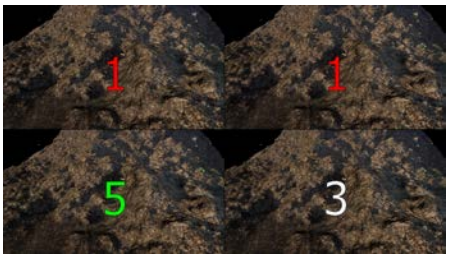
Scene: ST.MARTA1



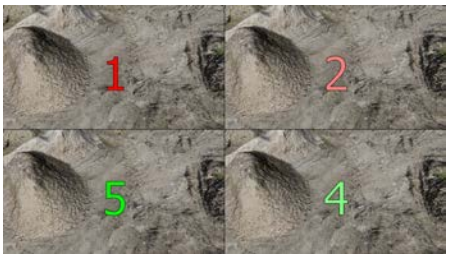
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



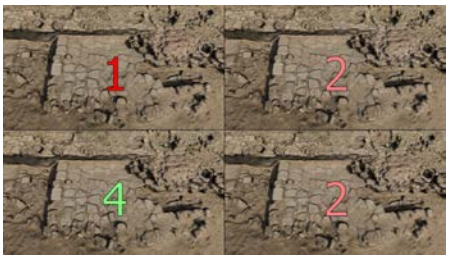
Scene: GROUND1

Figure 46: *Final data of the subject in the second user study session.*

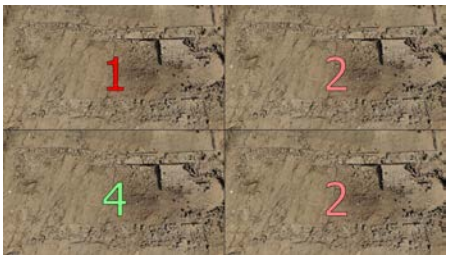
	Score
SWITCH	1.400(0.640)
LINEAR	2.000(0.400)
SMOOTHSTEP1	4.600(0.640)
SMOOTHSTEP2	4.000(0.400)

Table 43: *Final scores given by the subject to the techniques.*

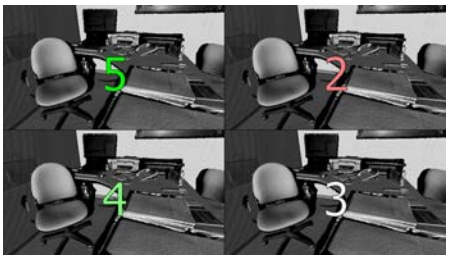
Subject 4 - Session 2



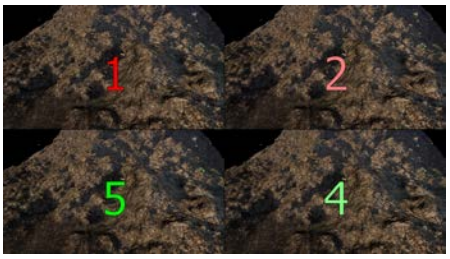
Scene: ST.MARTA1



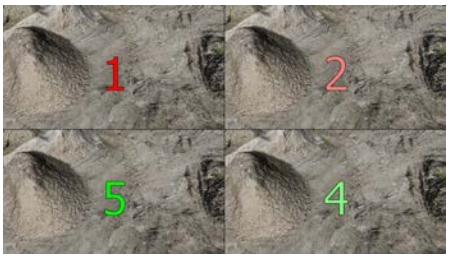
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



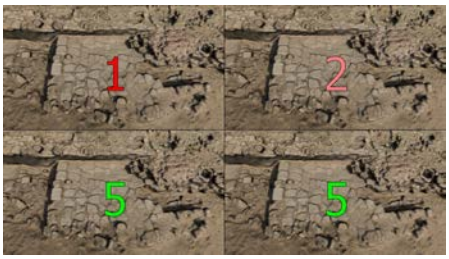
Scene: GROUND1

Figure 47: *Final data of the subject in the second user study session.*

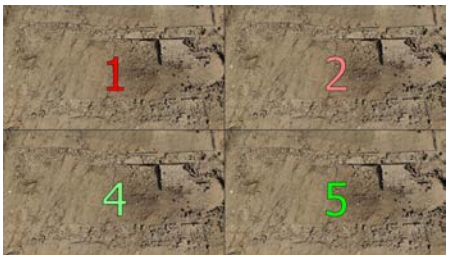
	Score
SWITCH	1.800(2.560)
LINEAR	2.000(0.000)
SMOOTHSTEP1	4.400(0.240)
SMOOTHSTEP2	3.000(0.800)

Table 44: *Final scores given by the subject to the techniques.*

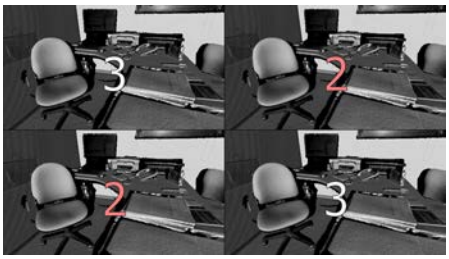
Subject 5 - Session 2



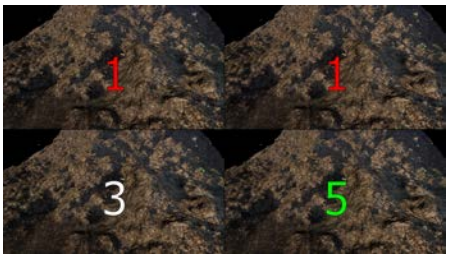
Scene: ST.MARTA1



Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

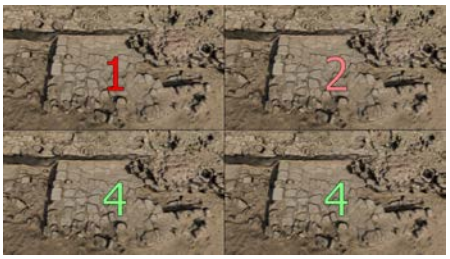
Scene: GROUND1

Figure 48: *Final data of the subject in the second user study session.*

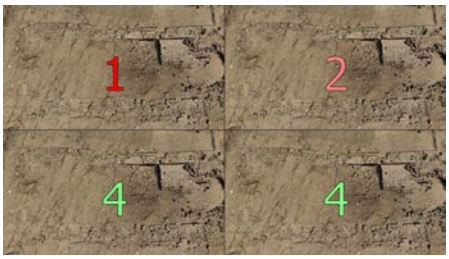
	Score
SWITCH	1.400(0.640)
LINEAR	1.600(0.240)
SMOOTHSTEP1	3.600(1.040)
SMOOTHSTEP2	4.200(0.960)

Table 45: *Final scores given by the subject to the techniques.*

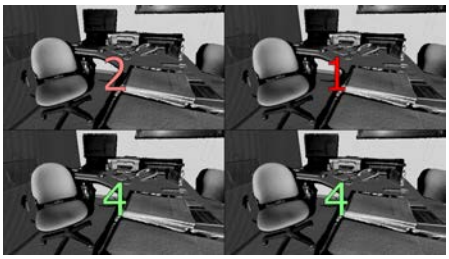
Subject 6 - Session 2



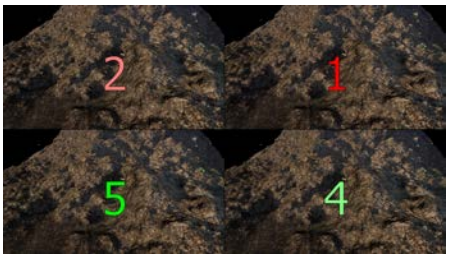
Scene: ST.MARTA1



Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

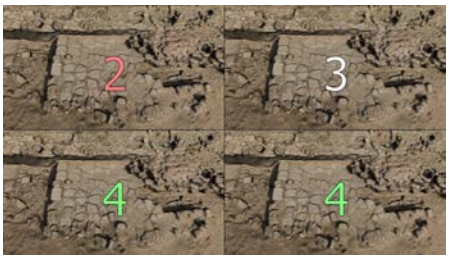
Scene: GROUND1

Figure 49: *Final data of the subject in the second user study session.*

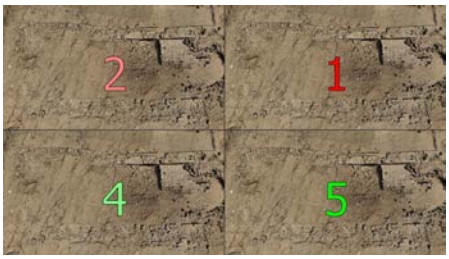
	Score
SWITCH	1.400(0.240)
LINEAR	1.800(0.560)
SMOOTHSTEP1	4.400(0.240)
SMOOTHSTEP2	4.000(0.000)

Table 46: *Final scores given by the subject to the techniques.*

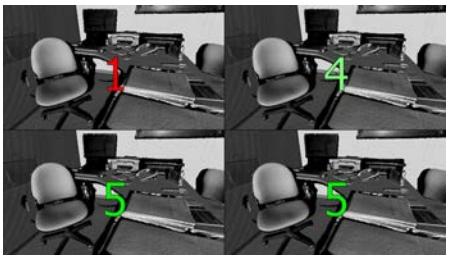
Subject 7 - Session 2



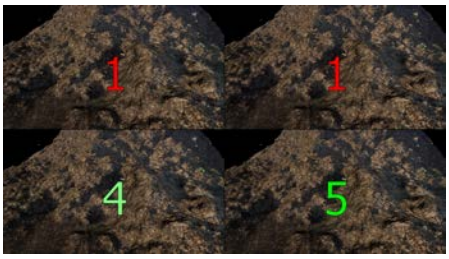
Scene: ST.MARTA1



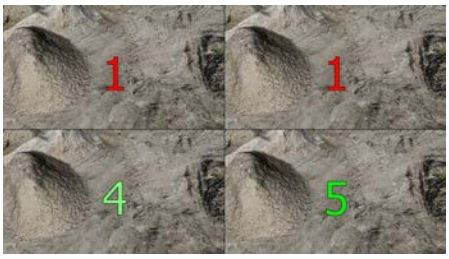
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



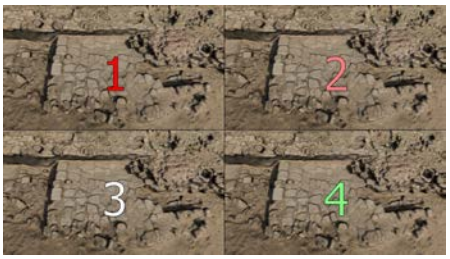
Scene: GROUND1

Figure 50: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.400(0.240)
LINEAR	2.000(1.600)
SMOOTHSTEP1	4.200(0.160)
SMOOTHSTEP2	4.800(0.160)

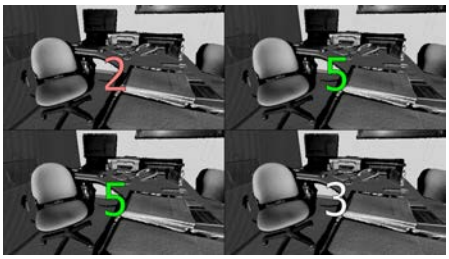
Table 47: *Final scores given by the subject to the techniques.*

Subject 8 - Session 2

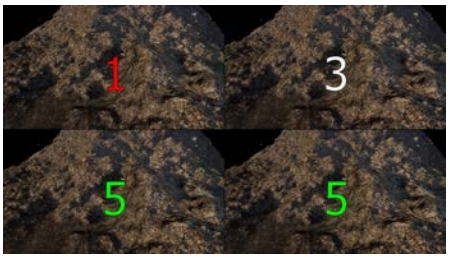


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

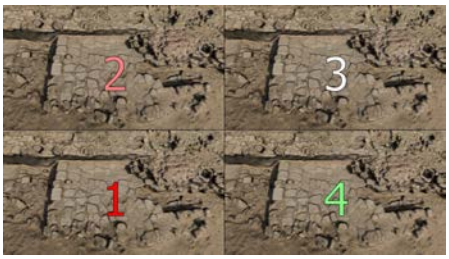
Scene: GROUND1

Figure 51: *Final data of the subject in the second user study session.*

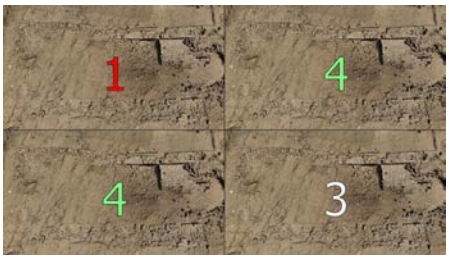
	Score
SWITCH	1.400(0.240)
LINEAR	3.400(1.040)
SMOOTHSTEP1	4.200(0.960)
SMOOTHSTEP2	3.400(1.040)

Table 48: *Final scores given by the subject to the techniques.*

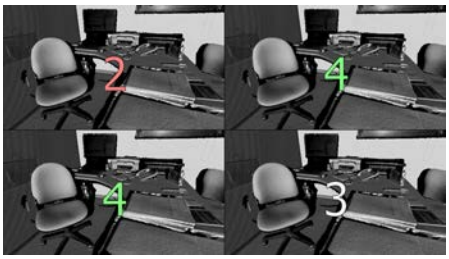
Subject 9 - Session 2



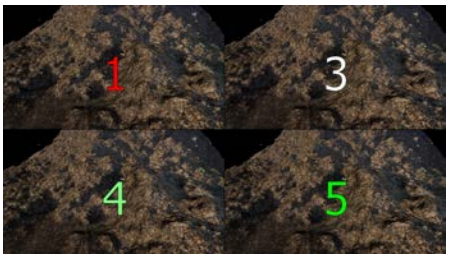
Scene: ST.MARTA1



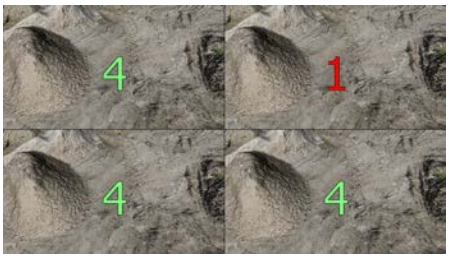
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



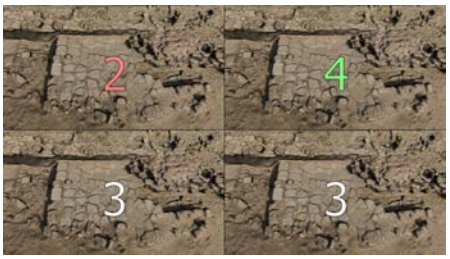
Scene: GROUND1

Figure 52: *Final data of the subject in the second user study session.*

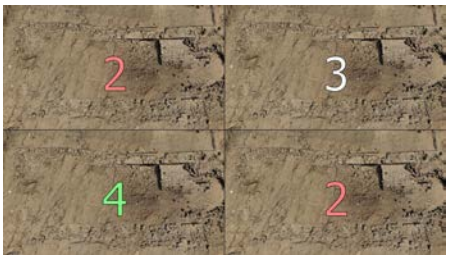
	Score
SWITCH	2.000(1.200)
LINEAR	3.000(1.200)
SMOOTHSTEP1	3.400(1.440)
SMOOTHSTEP2	3.800(0.560)

Table 49: *Final scores given by the subject to the techniques.*

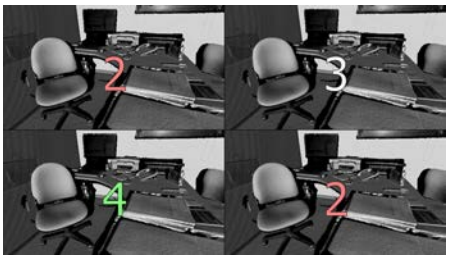
Subject 10 - Session 2



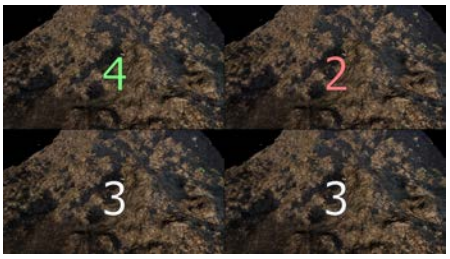
Scene: ST.MARTA1



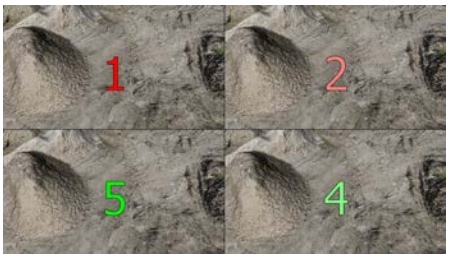
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



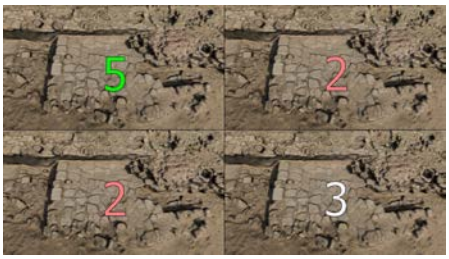
Scene: GROUND1

Figure 53: *Final data of the subject in the second user study session.*

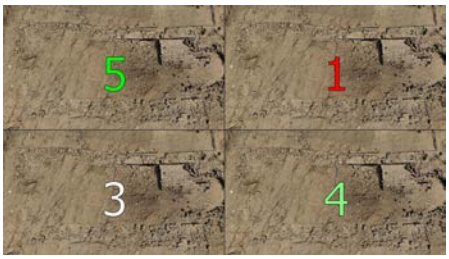
	Score
SWITCH	2.200(0.960)
LINEAR	2.800(0.560)
SMOOTHSTEP1	3.800(0.560)
SMOOTHSTEP2	2.800(0.560)

Table 50: *Final scores given by the subject to the techniques.*

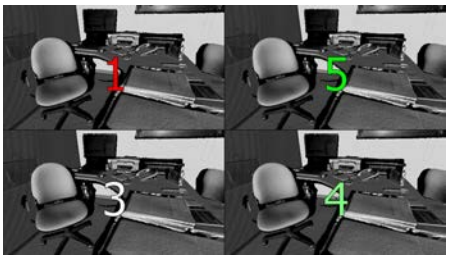
Subject 11 - Session 2



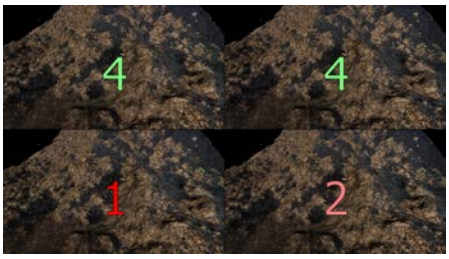
Scene: ST.MARTA1



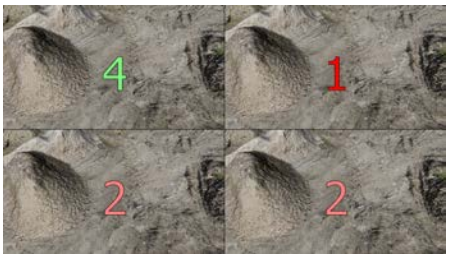
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



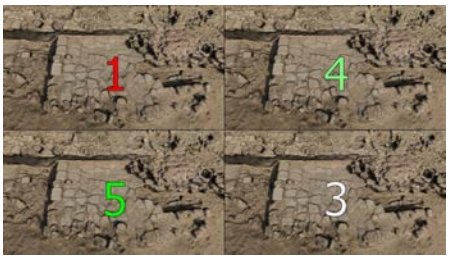
Scene: GROUND1

Figure 54: *Final data of the subject in the second user study session.*

	Score
SWITCH	3.800(2.160)
LINEAR	2.600(2.640)
SMOOTHSTEP1	2.200(0.560)
SMOOTHSTEP2	3.000(0.800)

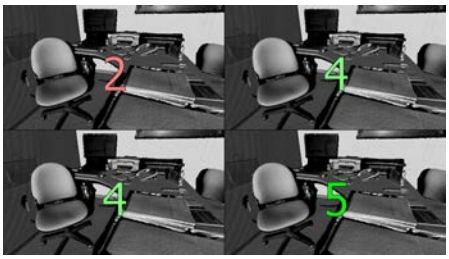
Table 51: *Final scores given by the subject to the techniques.*

Subject 12 - Session 2

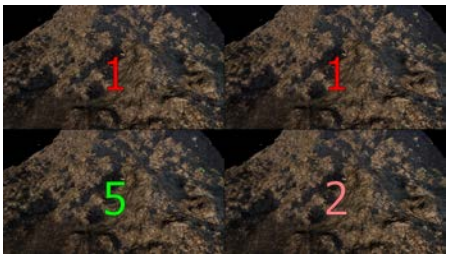


Scene: ST.MARTA1

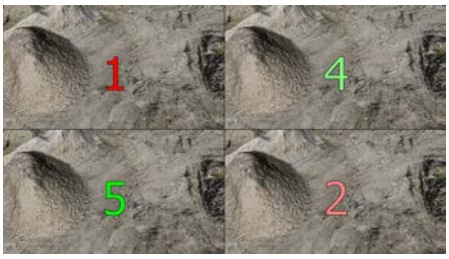
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



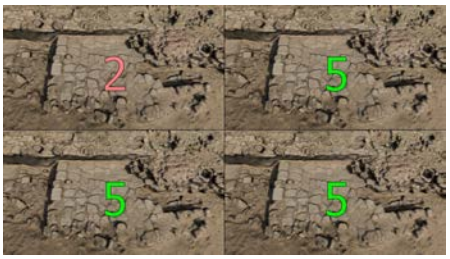
Scene: GROUND1

Figure 55: *Final data of the subject in the second user study session.*

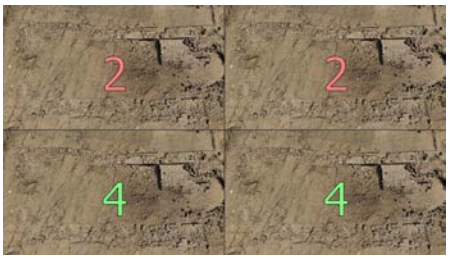
	Score
SWITCH	1.400(0.240)
LINEAR	3.200(1.360)
SMOOTHSTEP1	4.800(0.160)
SMOOTHSTEP2	3.200(1.360)

Table 52: *Final scores given by the subject to the techniques.*

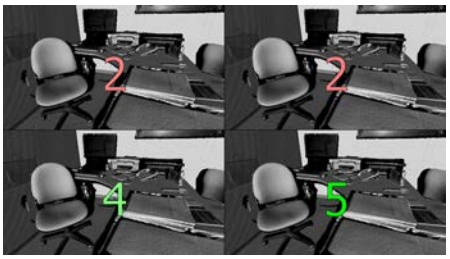
Subject 13 - Session 2



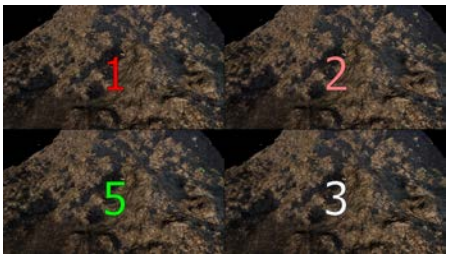
Scene: ST.MARTA1



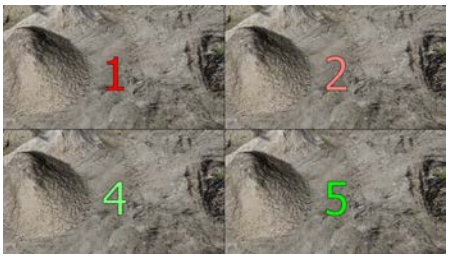
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



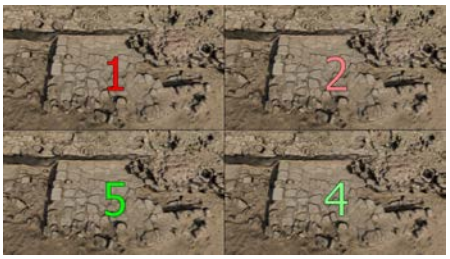
Scene: GROUND1

Figure 56: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.600(0.240)
LINEAR	2.600(1.440)
SMOOTHSTEP1	4.400(0.240)
SMOOTHSTEP2	4.400(0.640)

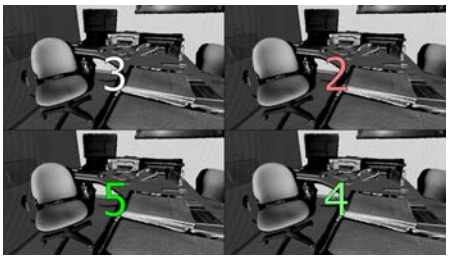
Table 53: *Final scores given by the subject to the techniques.*

Subject 14 - Session 2

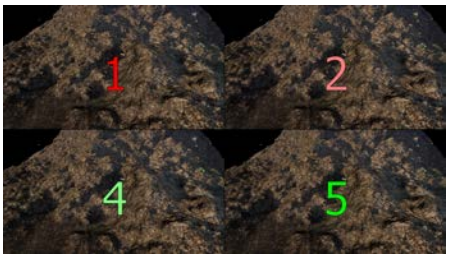


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

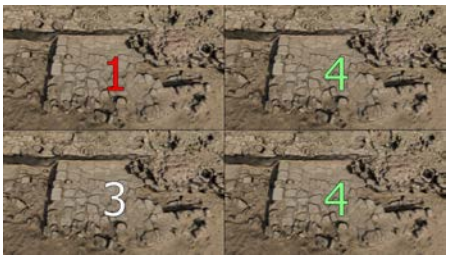
Scene: GROUND1

Figure 57: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.800(0.960)
LINEAR	2.200(0.160)
SMOOTHSTEP1	4.600(0.240)
SMOOTHSTEP2	4.600(0.240)

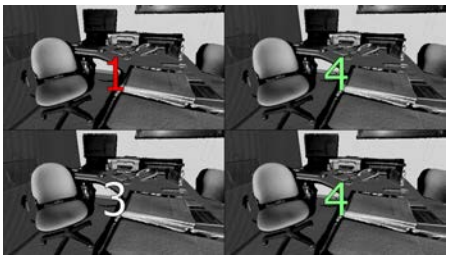
Table 54: *Final scores given by the subject to the techniques.*

Subject 15 - Session 2

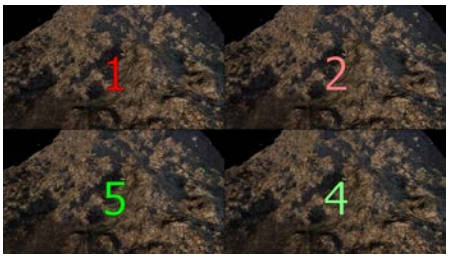


Scene: ST.MARTA1

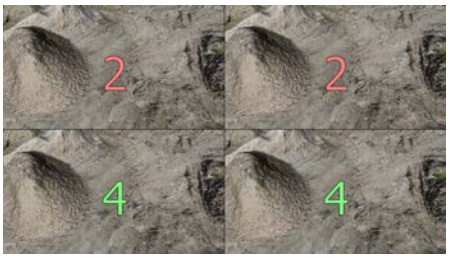
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



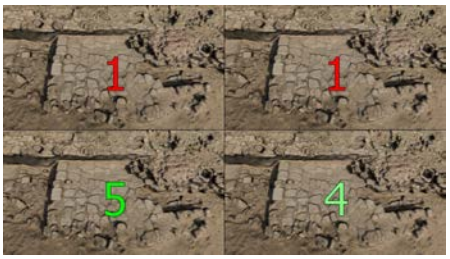
Scene: GROUND1

Figure 58: *Final data of the subject in the second user study session.*

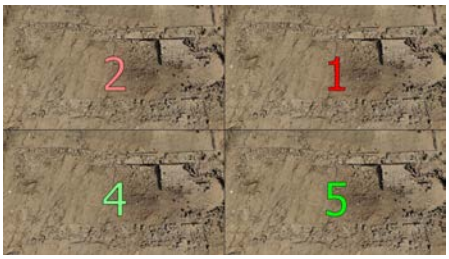
	Score
SWITCH	1.200(0.160)
LINEAR	3.200(0.960)
SMOOTHSTEP1	3.600(0.640)
SMOOTHSTEP2	4.200(0.160)

Table 55: *Final scores given by the subject to the techniques.*

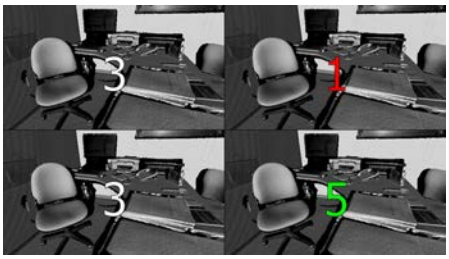
Subject 16 - Session 2



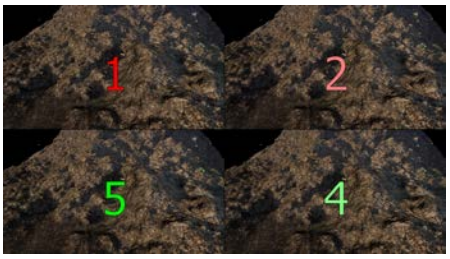
Scene: ST.MARTA1



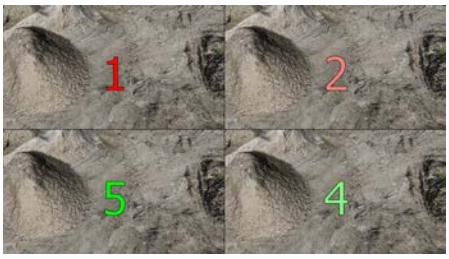
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



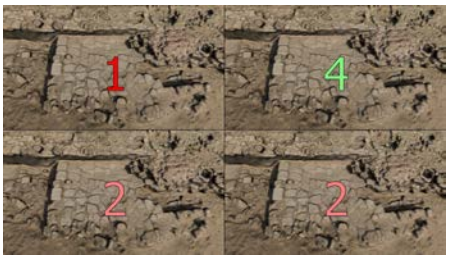
Scene: GROUND1

Figure 59: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.600(0.640)
LINEAR	1.400(0.240)
SMOOTHSTEP1	4.400(0.640)
SMOOTHSTEP2	4.400(0.240)

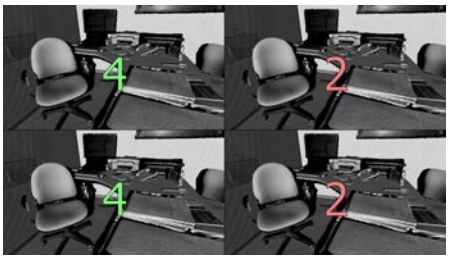
Table 56: *Final scores given by the subject to the techniques.*

Subject 17 - Session 2

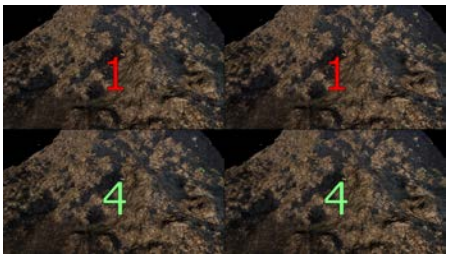


Scene: ST.MARTA1

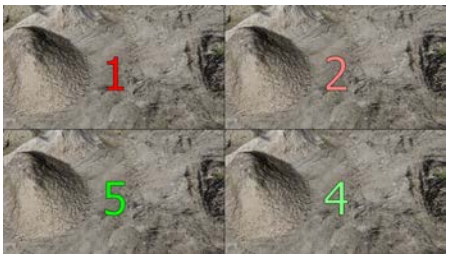
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



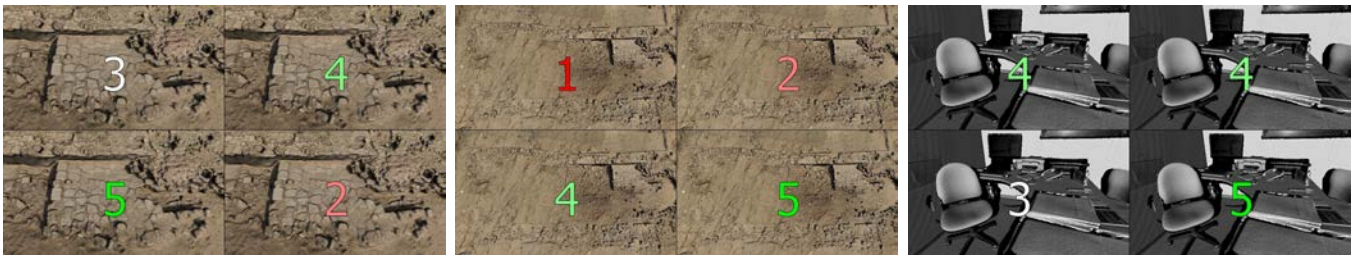
Scene: GROUND1

Figure 60: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.800(1.360)
LINEAR	2.400(1.040)
SMOOTHSTEP1	3.400(1.440)
SMOOTHSTEP2	2.600(1.440)

Table 57: *Final scores given by the subject to the techniques.*

Subject 18 - Session 2



Scene: ST.MARTA1 Scene: ST.MARTA2 Scene: OFFICE

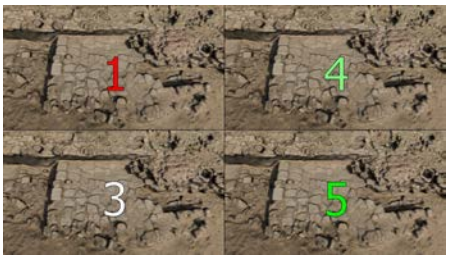
Scene: SEAWEED1 Scene: GROUND1

Figure 61: *Final data of the subject in the second user study session.*

	Score
SWITCH	2.200(1.360)
LINEAR	3.600(1.040)
SMOOTHSTEP1	4.200(0.560)
SMOOTHSTEP2	4.200(1.360)

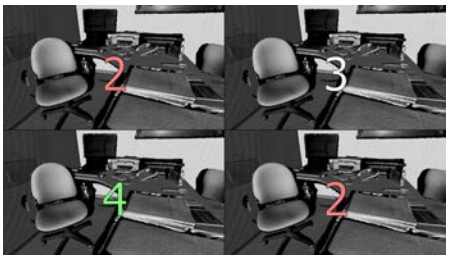
Table 58: *Final scores given by the subject to the techniques.*

Subject 19 - Session 2

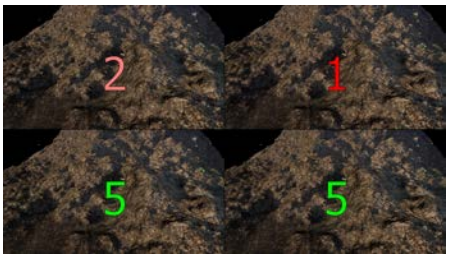


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

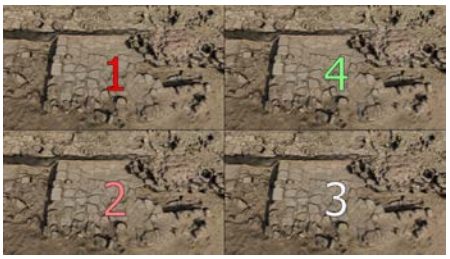
Scene: GROUND1

Figure 62: *Final data of the subject in the second user study session.*

	Score
SWITCH	2.000(0.400)
LINEAR	3.200(1.360)
SMOOTHSTEP1	4.000(0.800)
SMOOTHSTEP2	4.200(1.360)

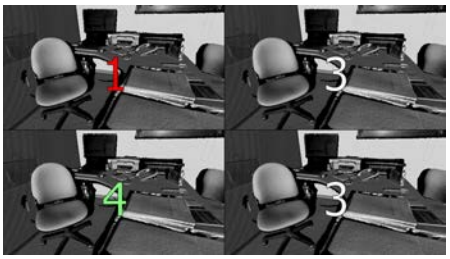
Table 59: *Final scores given by the subject to the techniques.*

Subject 20 - Session 2

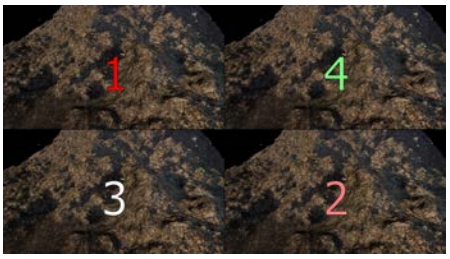


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

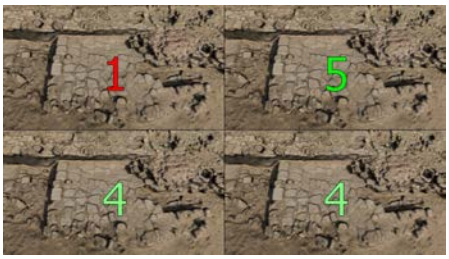
Scene: GROUND1

Figure 63: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.000(0.000)
LINEAR	3.800(0.160)
SMOOTHSTEP1	2.800(0.560)
SMOOTHSTEP2	2.600(0.240)

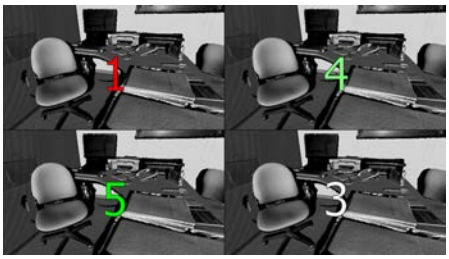
Table 60: *Final scores given by the subject to the techniques.*

Subject 21 - Session 2

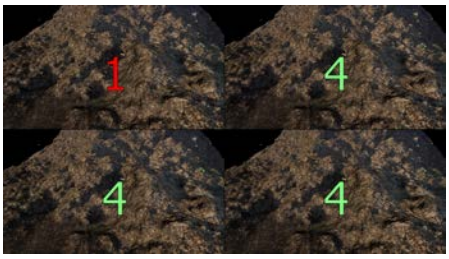


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

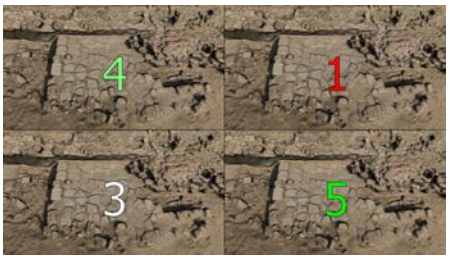
Scene: GROUND1

Figure 64: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.000(0.000)
LINEAR	4.400(0.240)
SMOOTHSTEP1	4.000(0.400)
SMOOTHSTEP2	4.000(0.400)

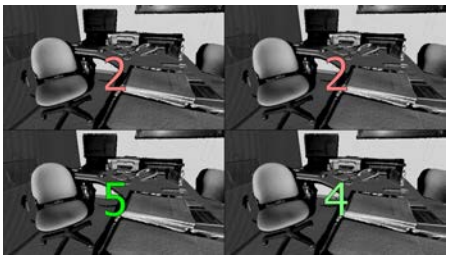
Table 61: *Final scores given by the subject to the techniques.*

Subject 22 - Session 2

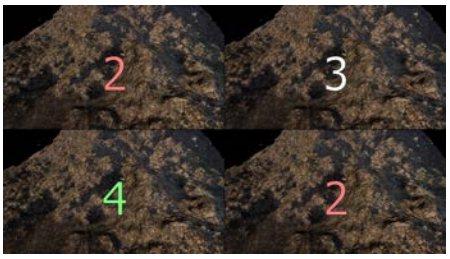


Scene: ST.MARTA1

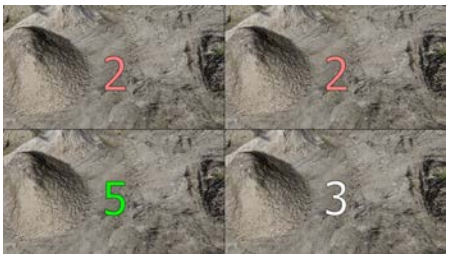
Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1



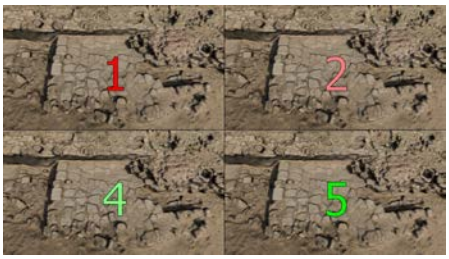
Scene: GROUND1

Figure 65: *Final data of the subject in the second user study session.*

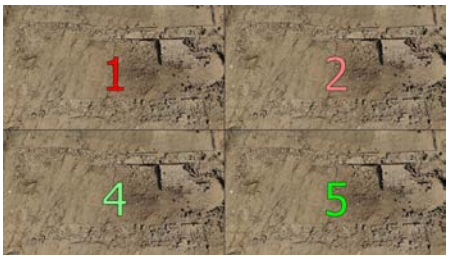
	Score
SWITCH	2.600(0.640)
LINEAR	2.400(1.040)
SMOOTHSTEP1	4.400(0.640)
SMOOTHSTEP2	3.400(1.040)

Table 62: *Final scores given by the subject to the techniques.*

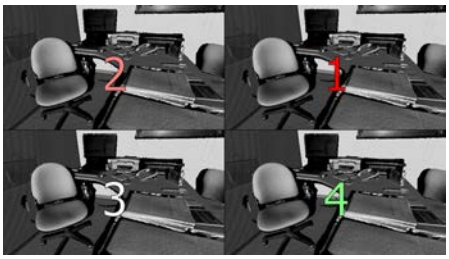
Subject 23 - Session 2



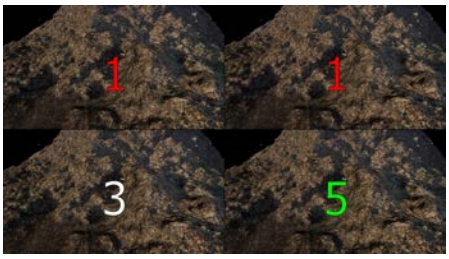
Scene: ST.MARTA1



Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

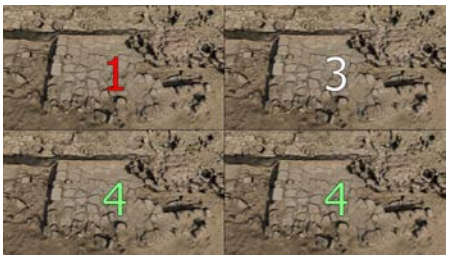
Scene: GROUND1

Figure 66: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.400(0.240)
LINEAR	1.400(0.240)
SMOOTHSTEP1	3.600(0.240)
SMOOTHSTEP2	4.800(0.160)

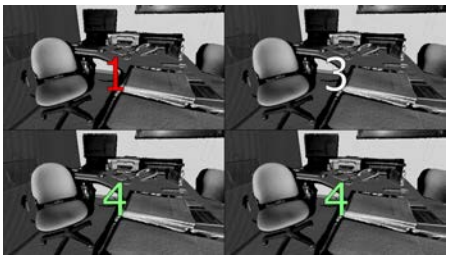
Table 63: *Final scores given by the subject to the techniques.*

Subject 24 - Session 2

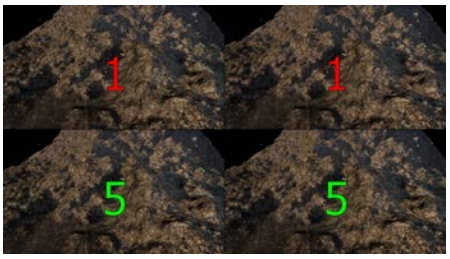


Scene: ST.MARTA1

Scene: ST.MARTA2



Scene: OFFICE



Scene: SEAWEED1

Scene: GROUND1

Figure 67: *Final data of the subject in the second user study session.*

	Score
SWITCH	1.000(0.000)
LINEAR	2.200(0.560)
SMOOTHSTEP1	3.800(0.560)
SMOOTHSTEP2	4.400(0.240)

Table 64: *Final scores given by the subject to the techniques.*

Markings Provided in the Third User Study Session Aggregated per Scene

SCENE1

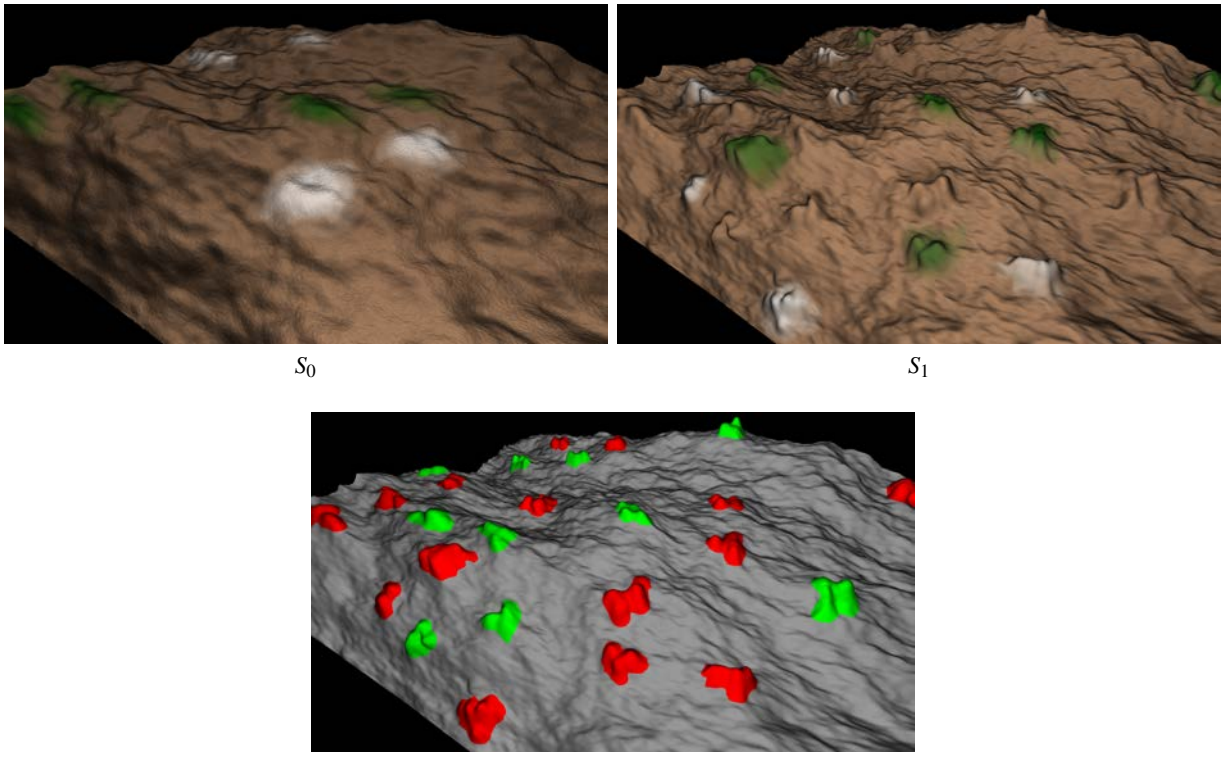
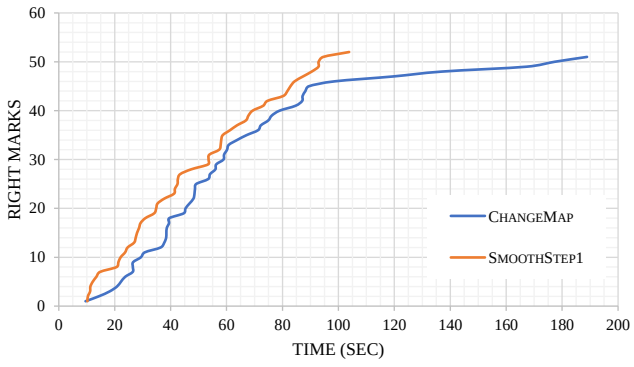


Figure 68: *Viewpoint used in the user study with the corresponding classification map that show of the change regions that should be marked in the test (green = change to mark, red = change to not mark, gray = no-change).*



	Time				
	20*s*	40*s*	60*s*	80*s*	End
CHANGEMAP	3 (0)	18 (0)	31 (0)	40 (0)	51 (0)
SMOOTHSTEP1	7 (0)	22 (1)	35 (1)	42 (1)	52 (2)

Figure 69: *Graph of the aggregated number of the right marks on the change areas in function of the elapsed time of the test. The bottom table shows the number of right marker at several times of the test (in parenthesis the wrong marks).*

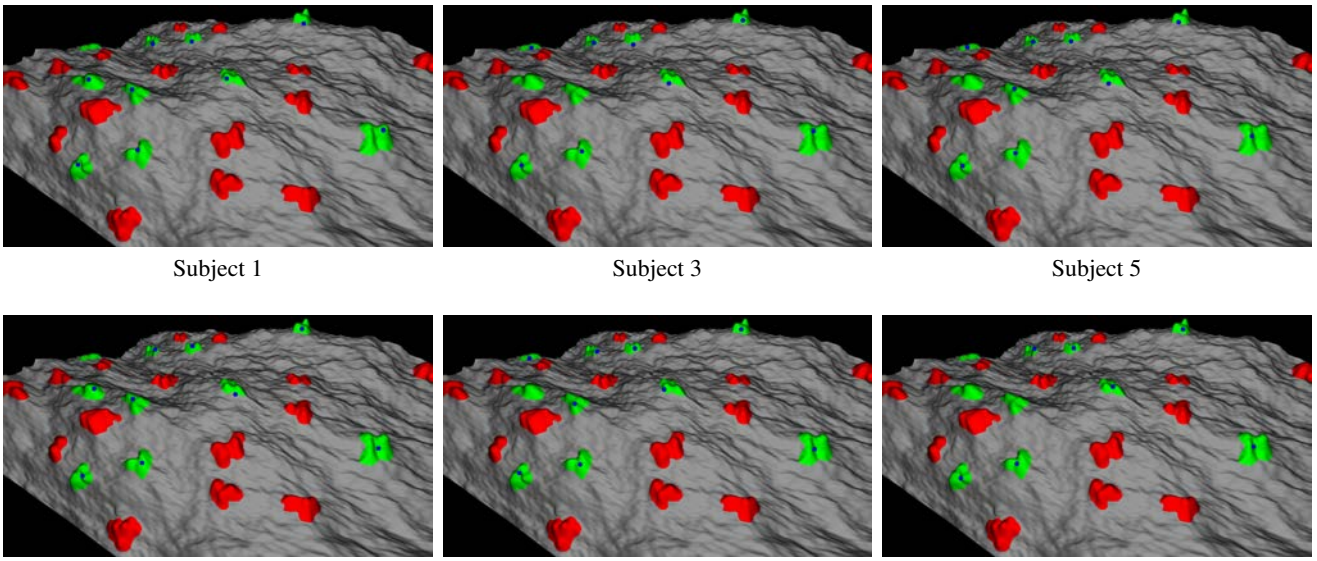


Figure 70: *Final data produced by the subjects in the third user study session using the method* CHANGEMAP. *The blue circles show the input of the subject.*

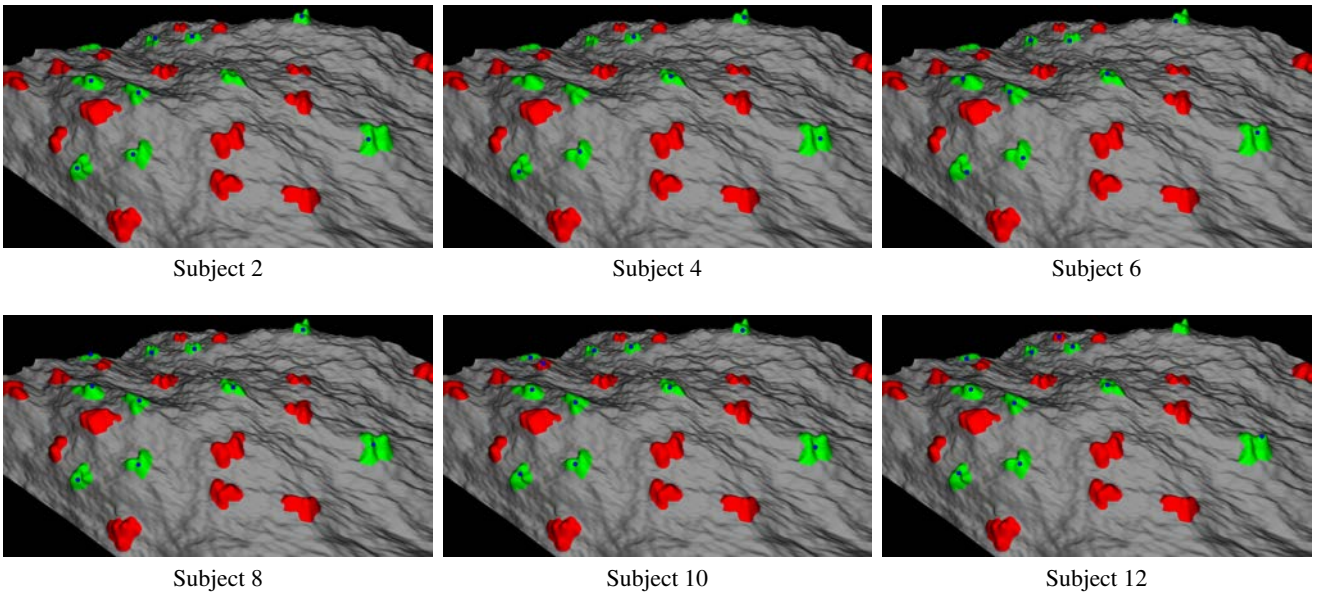


Figure 71: *Final data produced by the subjects in the third user study session using the method* SMOOTHSTEP1. *The blue circles show the input of the subject.*

SCENE2

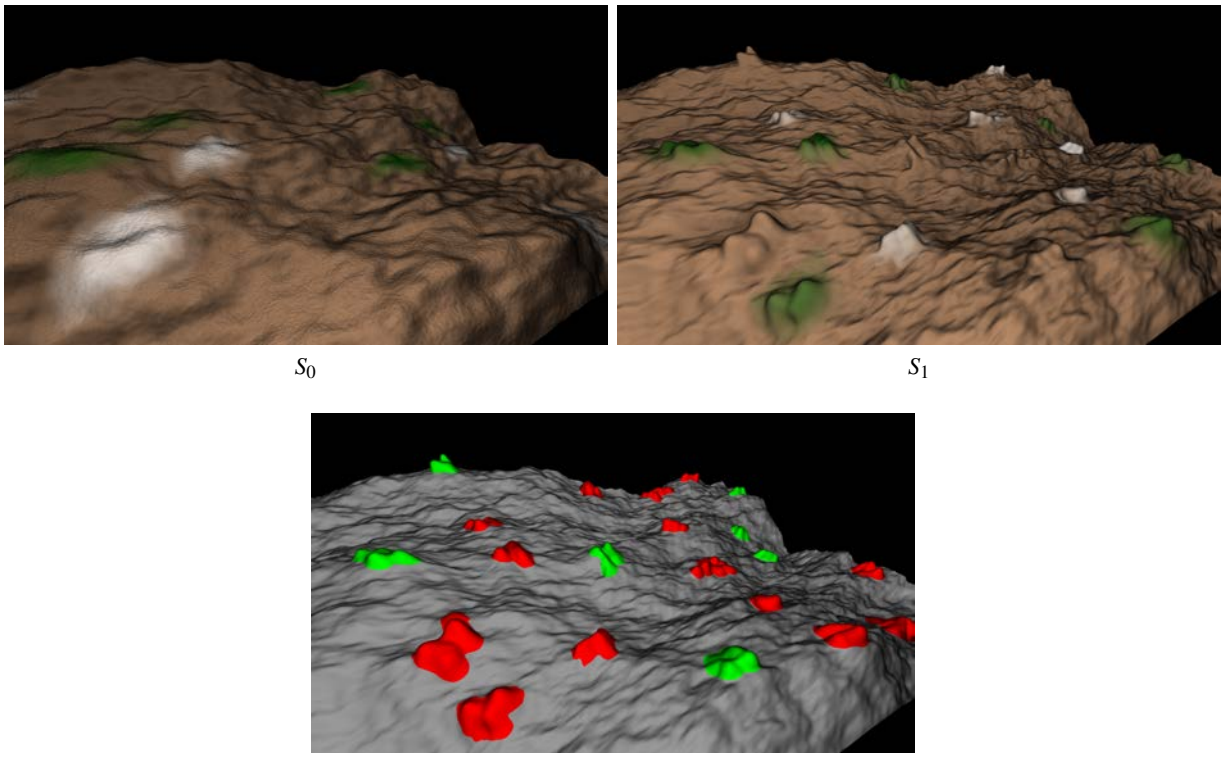
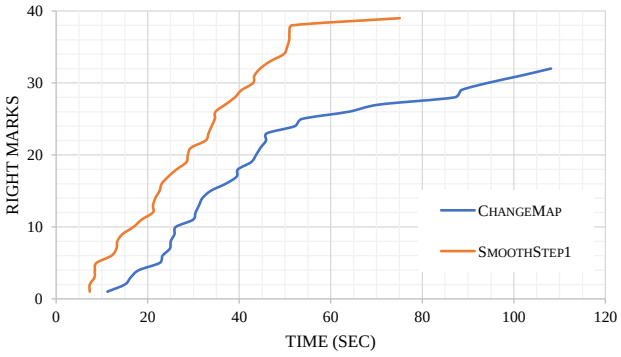


Figure 72: *Viewpoint used in the user study with the corresponding classification map that show of the change regions that should be marked in the test (green = change to mark, red = change to not mark, gray = no-change).*



	Time				
	20*s*	40*s*	60*s*	80*s*	End
CHANGEMAP	4 (0)	18 (2)	25 (2)	27 (2)	32 (2)
SMOOTHSTEP1	11 (0)	28 (1)	38 (1)	39 (1)	39 (1)

Figure 73: *Graph of the aggregated number of the right marks on the change areas in function of the elapsed time of the test. The bottom table shows the number of right marker at several times of the test (in parenthesis the wrong marks).*

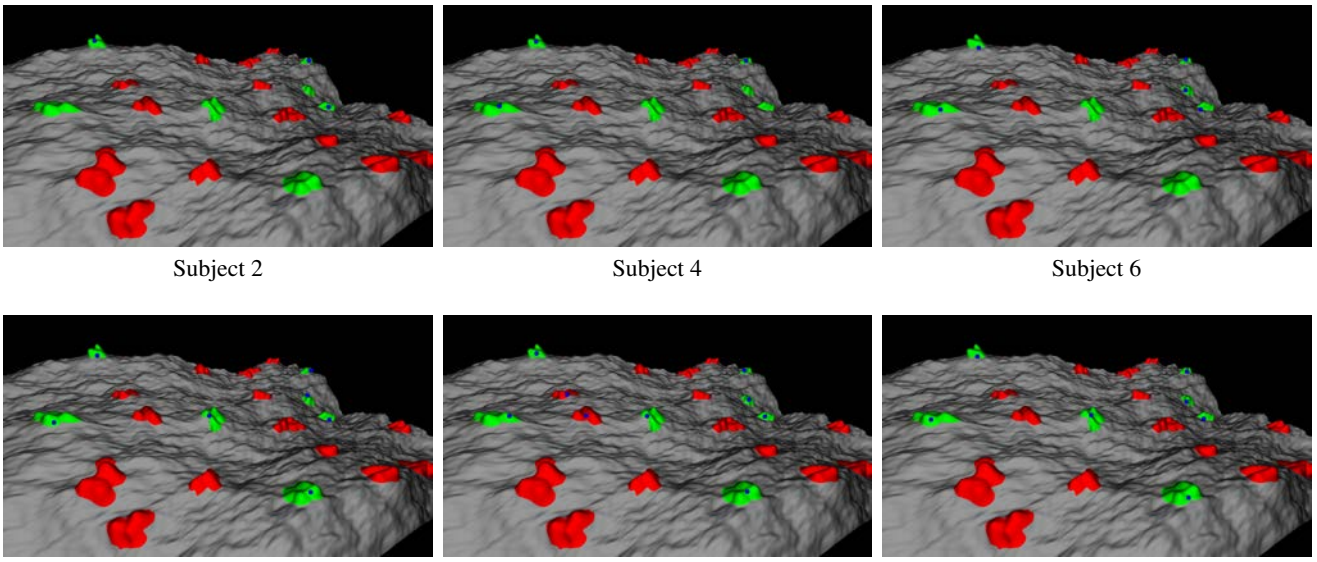


Figure 74: *Final data produced by the subjects in the third user study session using the method* CHANGEMAP. *The blue circles show the input of the subject.*

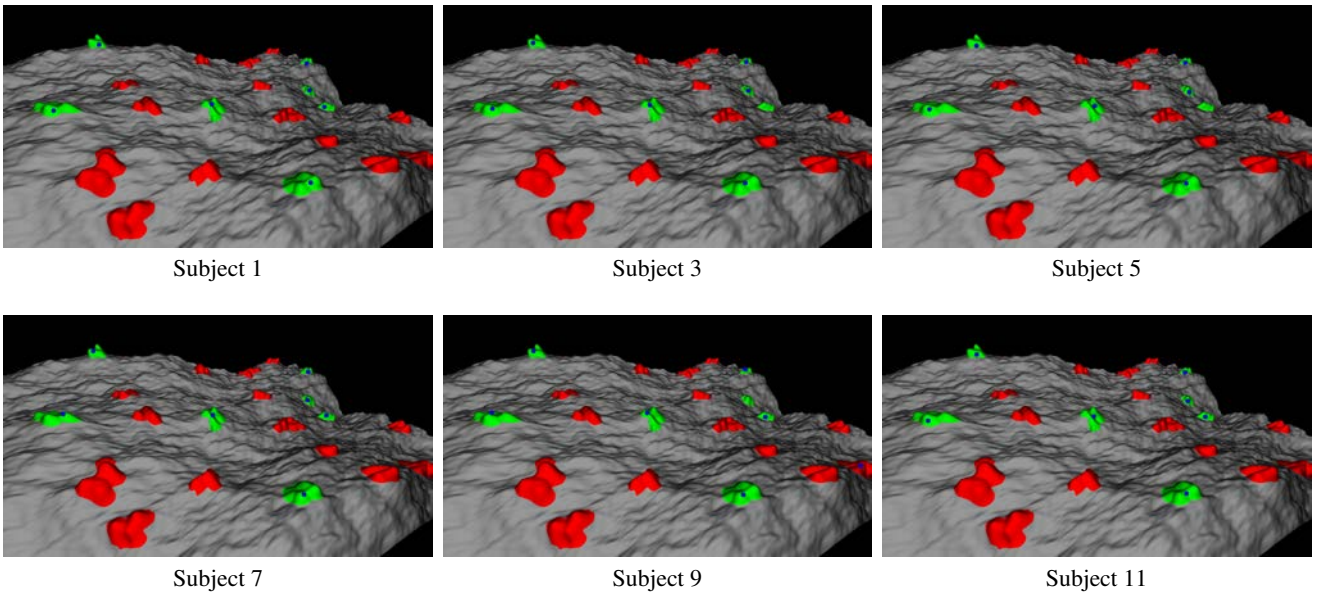


Figure 75: *Final data produced by the subjects in the third user study session using the method* SMOOTHSTEP1. *The blue circles show the input of the subject.*

SCENE3

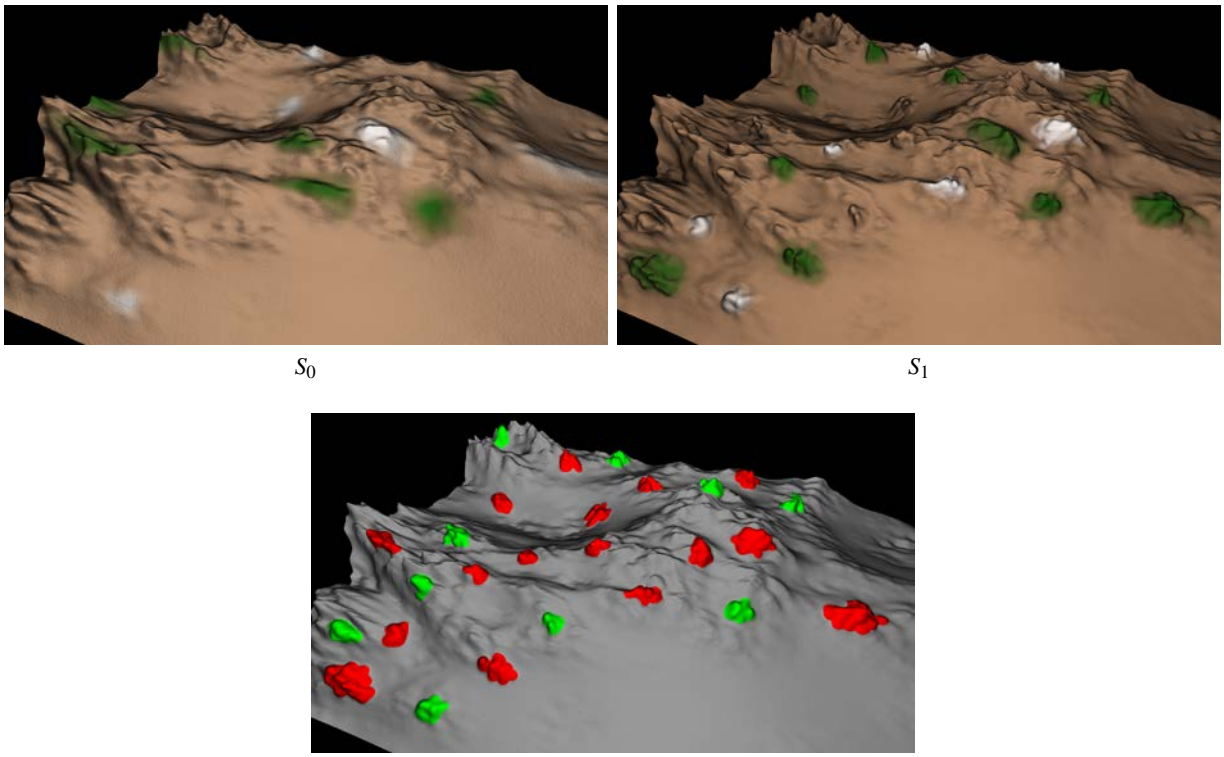
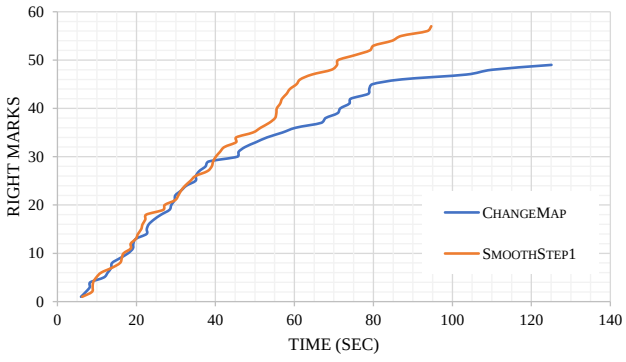


Figure 76: *Viewpoint used in the user study with the corresponding classification map that show of the change regions that should be marked in the test (green = change to mark, red = change to not mark, gray = no-change).*



	Time				
	20*s*	40*s*	60*s*	80*s*	End
CHANGEMAP	13 (0)	29 (0)	35 (0)	45 (0)	49 (0)
SMOOTHSTEP1	13 (1)	29 (1)	44 (1)	52 (1)	57 (1)

Figure 77: *Graph of the aggregated number of the right marks on the change areas in function of the elapsed time of the test. The bottom table shows the number of right marker at several times of the test (in parenthesis the wrong marks).*

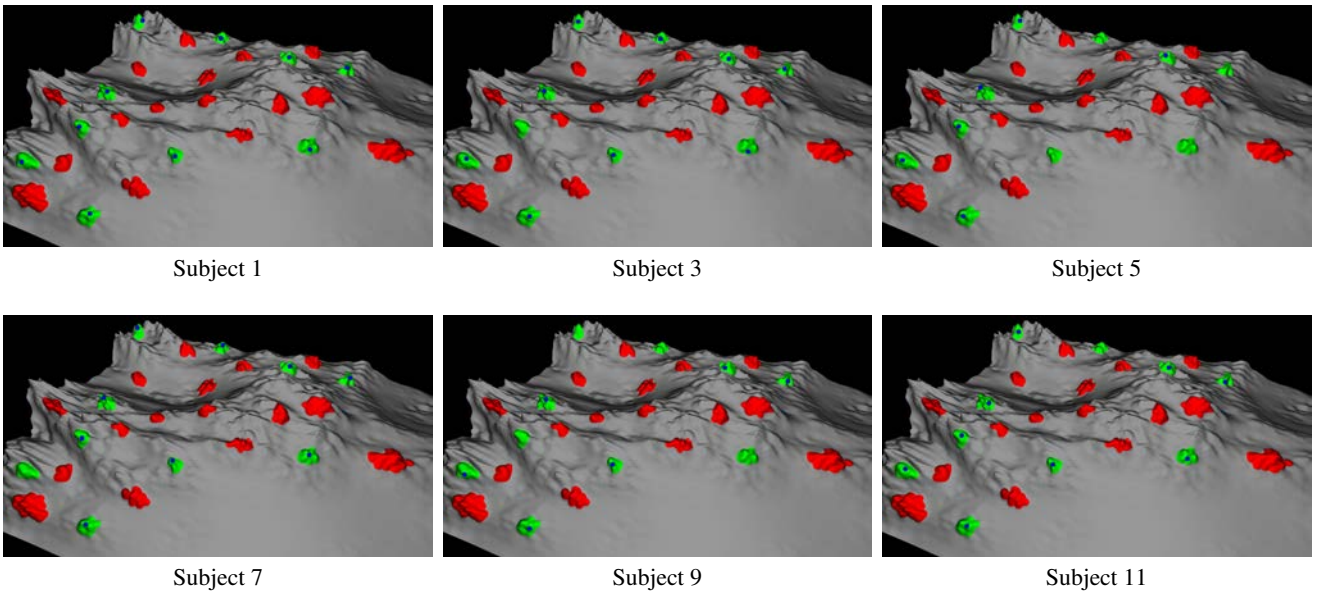


Figure 78: *Final data produced by the subjects in the third user study session using the method* CHANGEMAP. *The blue circles show the input of the subject.*

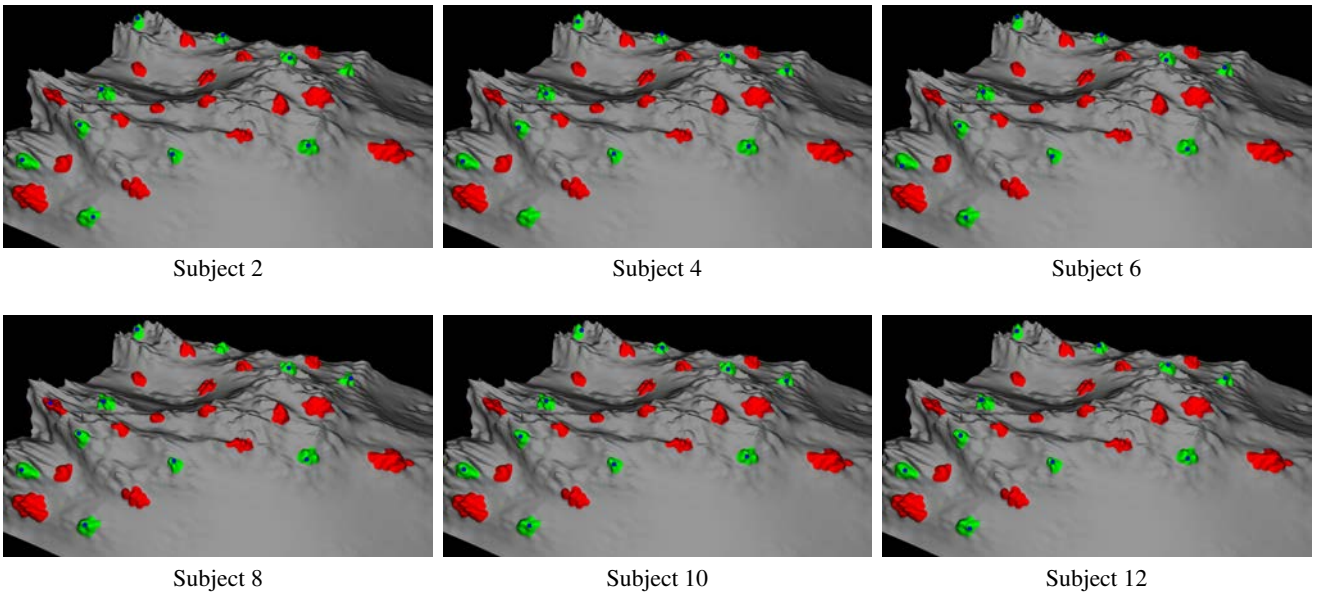


Figure 79: *Final data produced by the subjects in the third user study session using the method* SMOOTHSTEP1. *The blue circles show the input of the subject.*

SCENE4

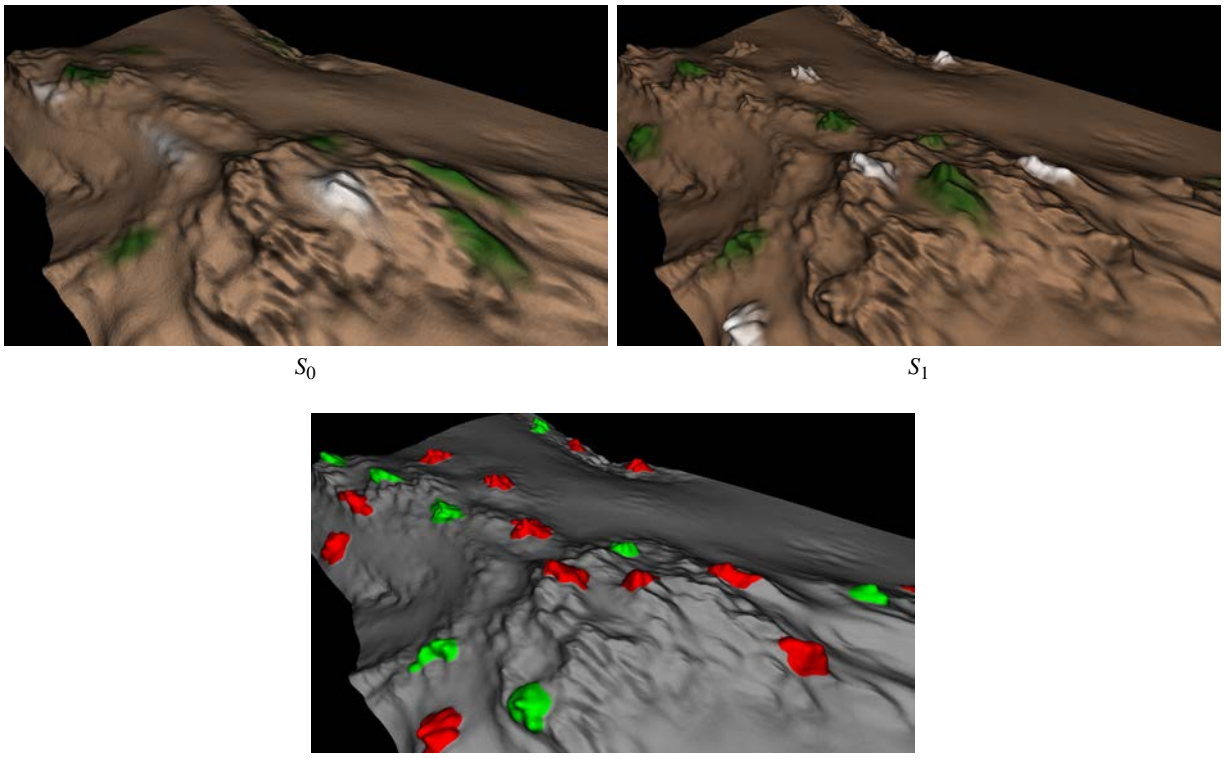
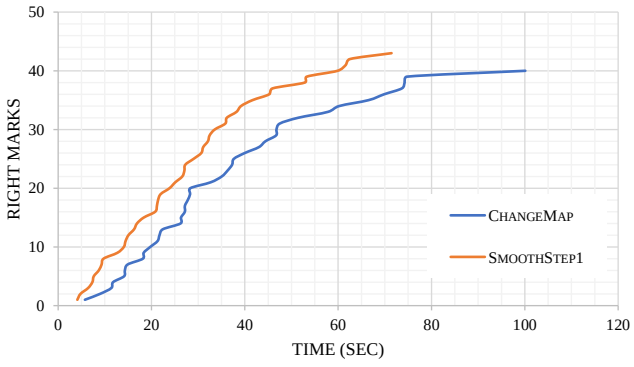


Figure 80: *Viewpoint used in the user study with the corresponding classification map that show of the change regions that should be marked in the test (green = change to mark, red = change to not mark, gray = no-change).*



	Time				
	20*s*	40*s*	60*s*	80*s*	End
CHANGEMAP	10 (0)	25 (0)	33 (0)	39 (0)	40 (0)
SMOOTHSTEP1	15 (1)	34 (2)	40 (2)	43 (2)	43 (2)

Figure 81: *Graph of the aggregated number of the right marks on the change areas in function of the elapsed time of the test. The bottom table shows the number of right marker at several times of the test (in parenthesis the wrong marks).*

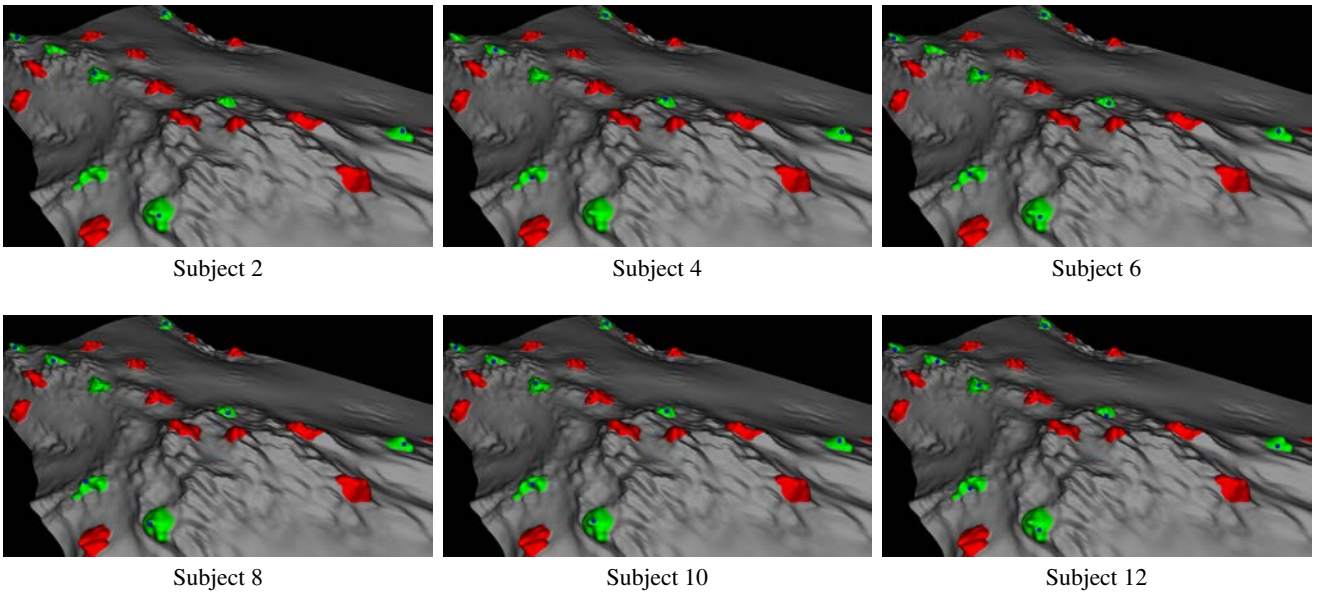


Figure 82: *Final data produced by the subjects in the third user study session using the method* CHANGEMAP. *The blue circles show the input of the subject.*

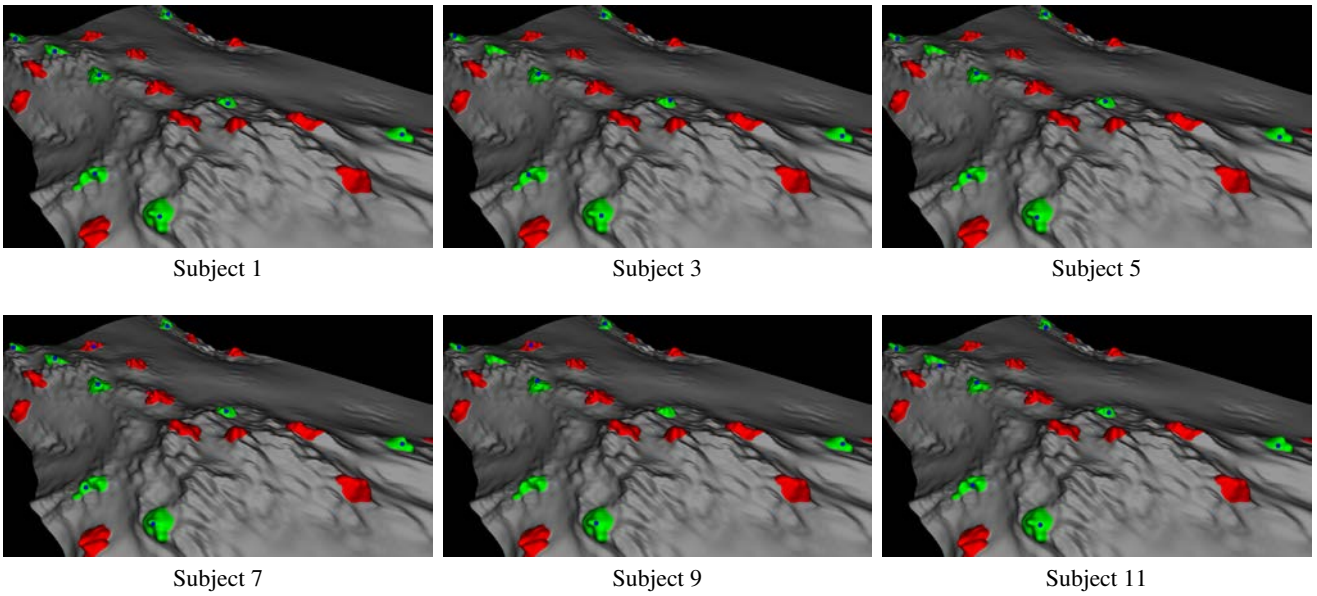


Figure 83: *Final data produced by the subjects in the third user study session using the method* SMOOTHSTEP1. *The blue circles show the input of the subject.*