# Supplemental Document for "Change Blindness Images"

This supplemental document provides additional user study results for the paper submission entitled "Change Blindness Images".
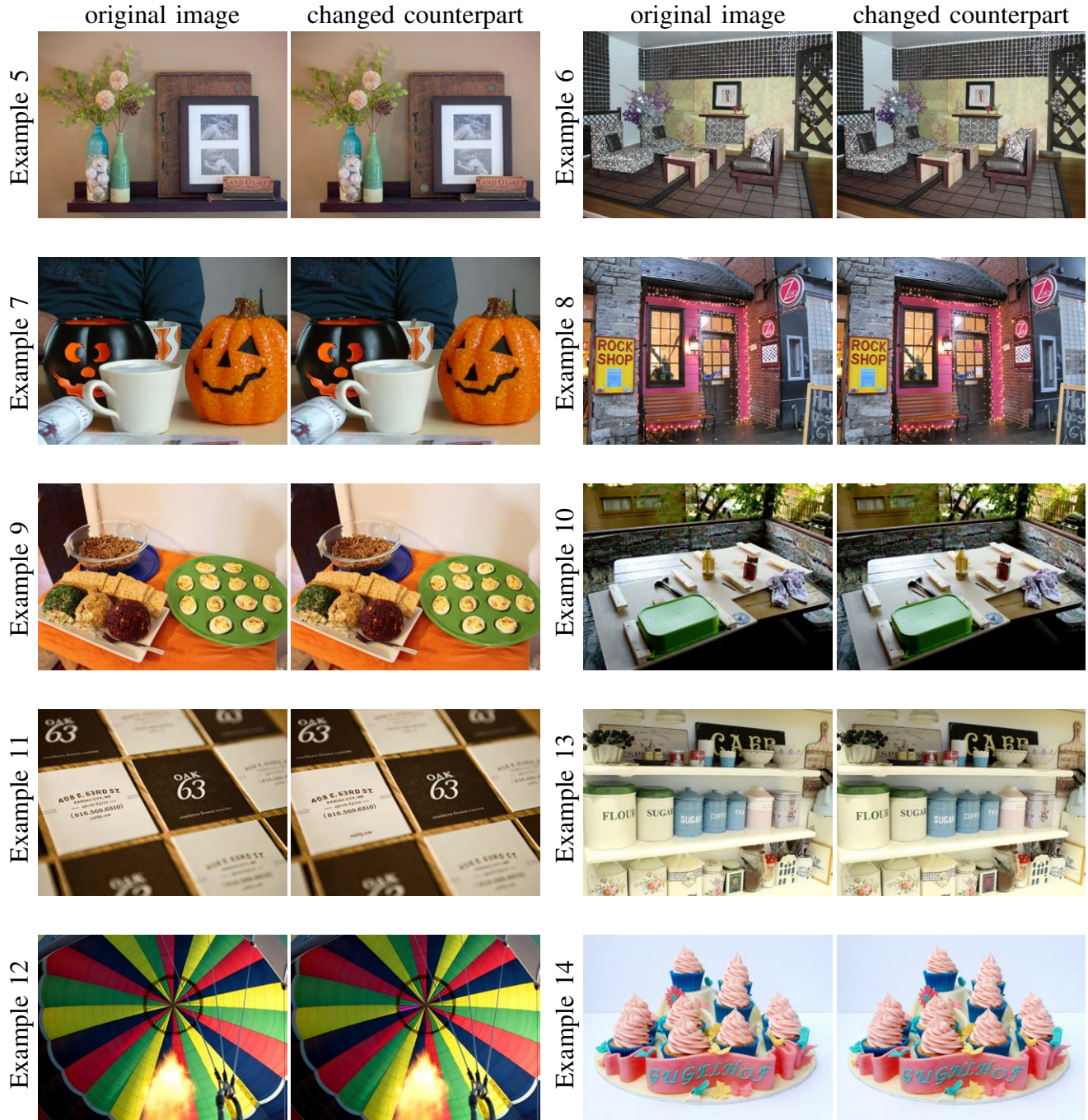
I. USER STUDY 1

In this section, we provide all the 100 real-world images and the 100 generated changed counterparts that are used in our user study. For each image pair, we provide the predicted blindness by our metric, the predicted recognition time (predicted blindness * 60), the average measured recognition time, intra image (inter subject) standard deviation of the measured recognition times, and the relative error (between the predicted and average measured recognition times). Change locations could be found in Figures 7 & 14.

A. Training Set
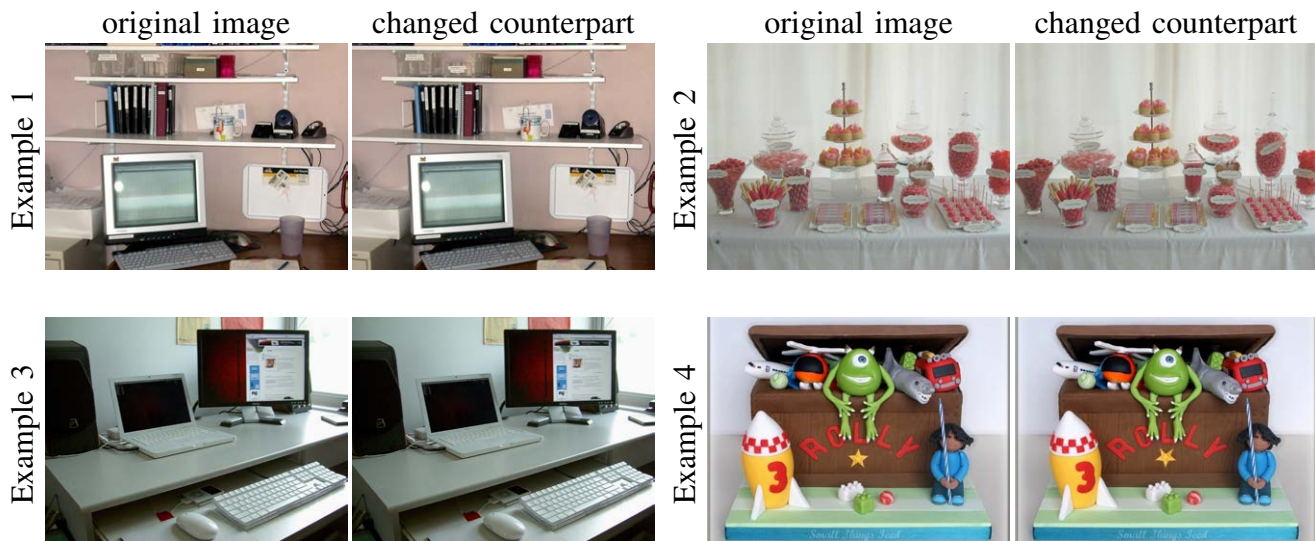
Example	1	2	3	4
predicted blindness	0.944	0.915	0.902	0.888
predicted recognition time (s)	56.6	54.9	54.1	53.3
measured recognition time (s)	37.6	50.2	60	56.8
standard deviation (s)	5.4	15.6	11	10.2
relative error(s)	19.0	4.7	-5.9	-3.5

Fig. 1.   Examples 1 - 4.

	original image	changed counterpart		original image	changed counterpart
Example 5			Example 6		
Example 7			Example 8		
Example 9			Example 10		
Example 11			Example 13		
Example 12			Example 14		

Example	5	6	7	8	9	10	11	12	13	14
predicted blindness	0.850	0.800	0.782	0.778	0.757	0.748	0.735	0.705	0.703	0.702
predicted recognition time (s)	51.0	48.0	46.9	46.7	45.4	44.9	44.1	42.3	42.2	42.1
measured recognition time (s)	45.3	59.4	44.2	42.2	59.5	23.5	46.9	38.5	29.5	24.3
standard deviation (s)	15.1	3.2	6.8	19.2	6.5	7.2	6.6	13.8	12.2	6.7
relative error(s)	5.7	-11.4	2.7	4.5	-14.1	21.4	-2.8	3.8	12.7	17.8

Fig. 2.   Examples 5 - 14.
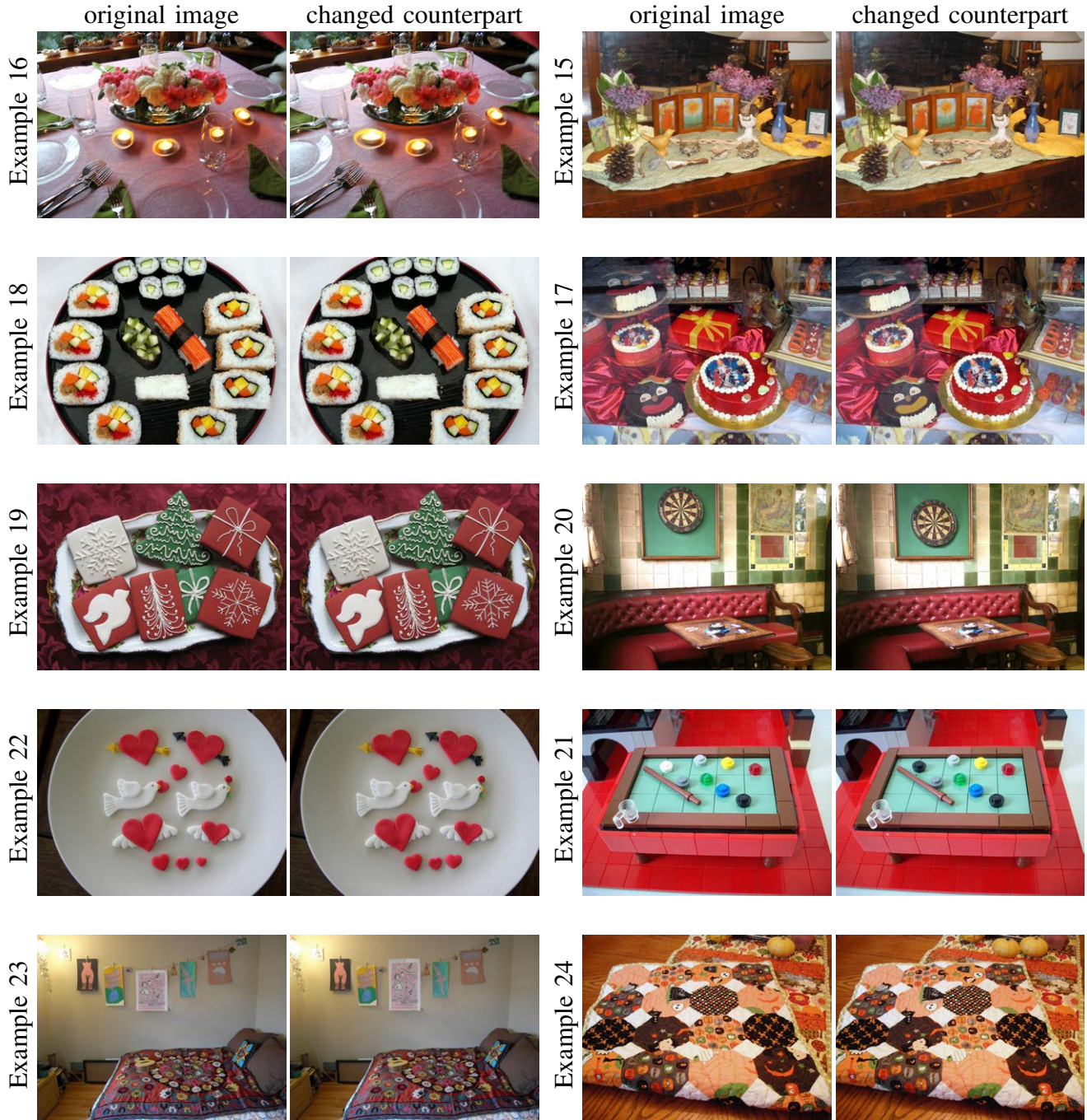
Example	15	16	17	18	19	20	21	22	23	24
predicted blindness	0.532	0.504	0.418	0.397	0.388	0.333	0.277	0.270	0.233	0.201
predicted recognition time (s)	31.9	30.2	25.1	23.8	23.3	20.0	16.6	16.2	14.0	12.1
measured recognition time (s)	36.6	23.2	34.3	20.9	27.6	3.54	14.4	11.1	27.6	5.3
standard deviation (s)	14.3	6.9	11.3	13.8	4.5	4.5	9.6	6.2	11.1	1.3
relative error(s)	-4.7	7.0	-9.2	2.9	-4.3	16.4	2.2	5.1	-13.6	6.8

Fig. 3.   Examples 15 - 24.
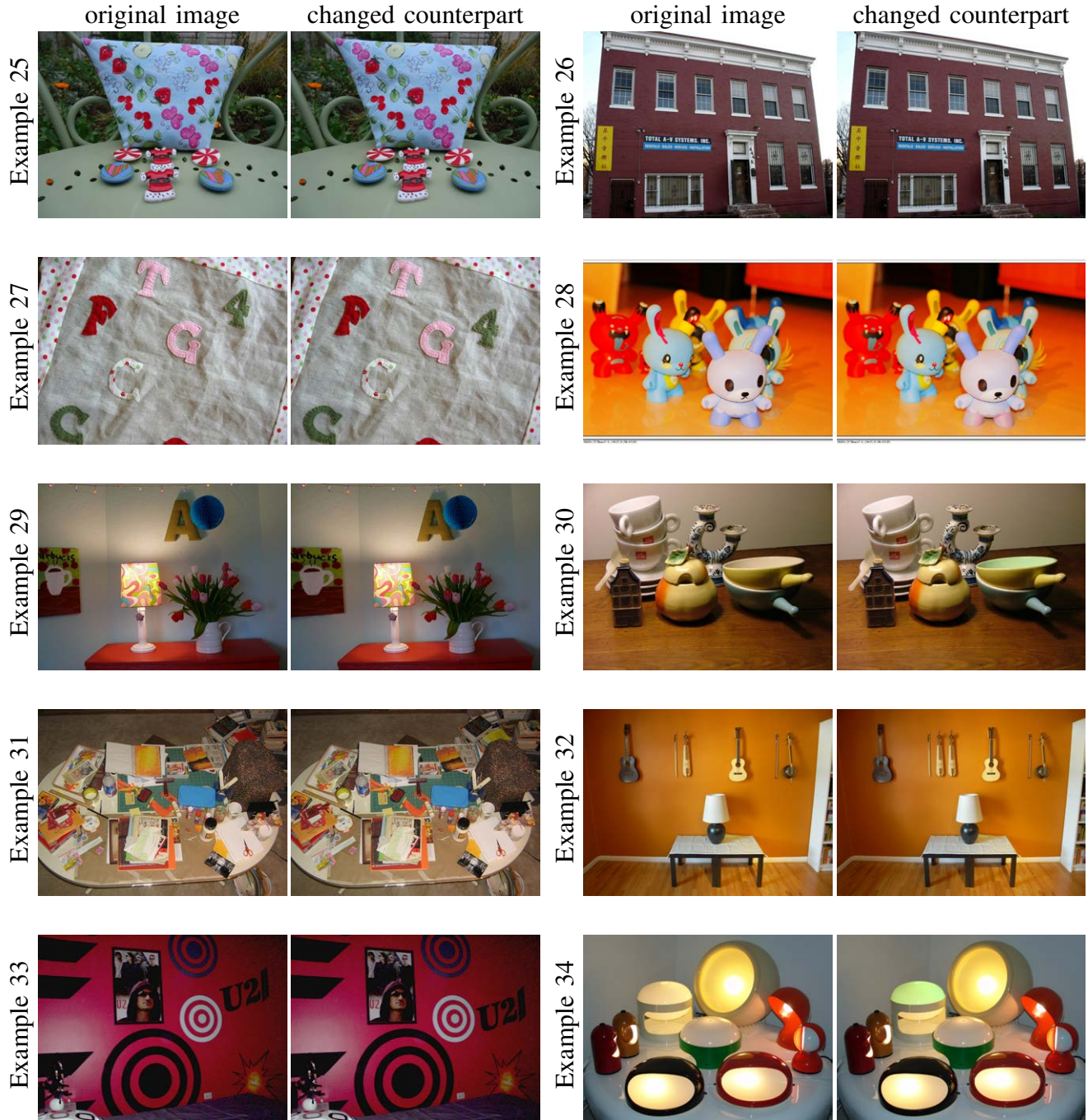
Example	25	26	27	28	29	30	31	32	33	34
predicted blindness	0.175	0.133	0.095	0.081	0.047	0.033	0.029	0.011	0.005	0.003
predicted recognition time (s)	10.5	8.0	5.7	4.9	2.8	2.0	1.7	0.7	0.3	0.2
measured recognition time (s)	22.3	15.5	28.8	18.6	12.9	20.0	23.8	4.6	22.5	5.5
standard deviation (s)	9.6	2.4	7.4	7.4	6.1	10.7	6.6	0.6	11.9	2.1
relative error(s)	-11.8	-7.5	-23.1	-13.7	-10.1	-18.0	-22.1	-3.9	-22.2	-5.3

Fig. 4.   Examples 25 - 34.

Fig. 5.   Examples 35 - 42.
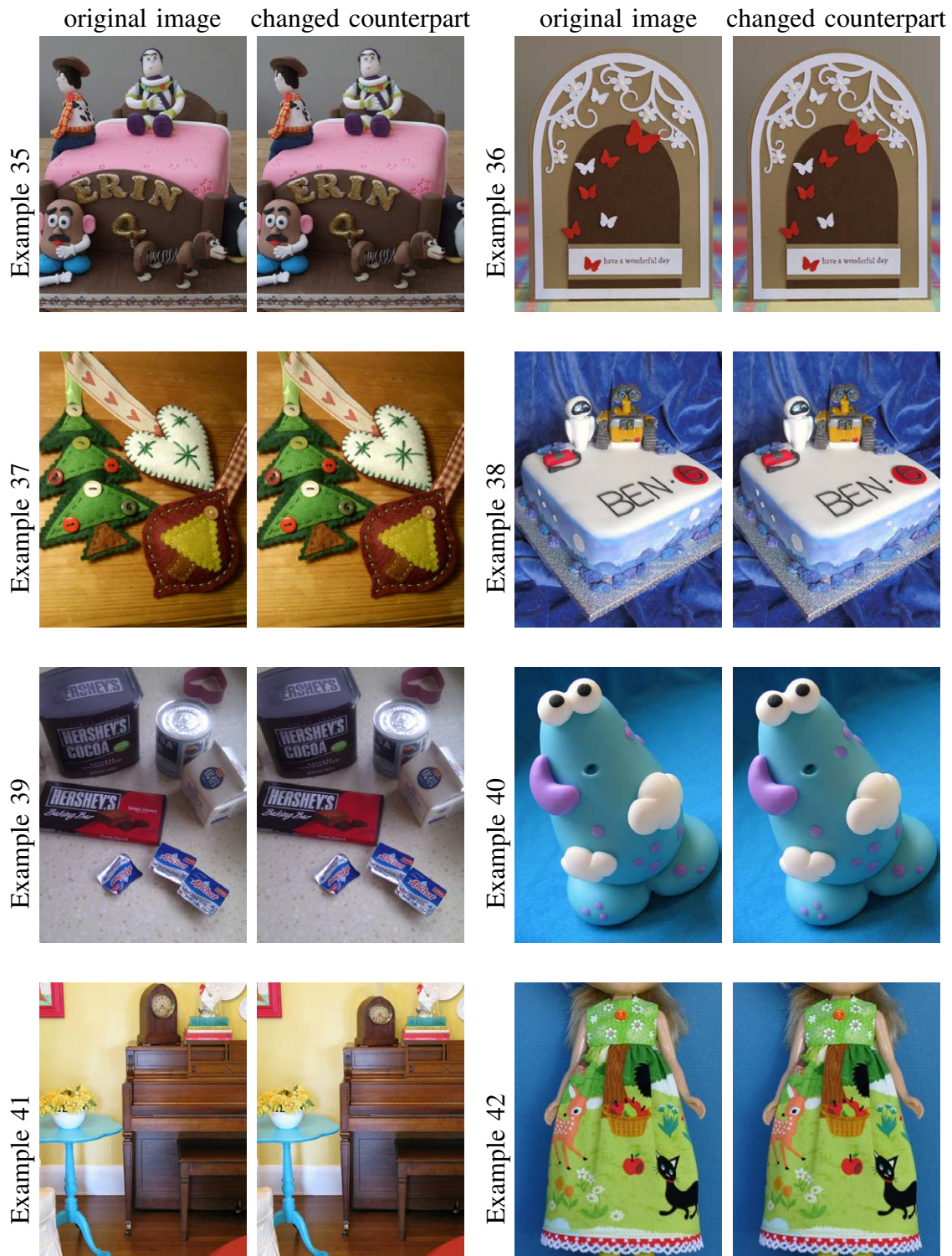
Example	35	36	37	38	39	40	41	42
predicted blindness	0.934	0.864	0.804	0.766	0.674	0.557	0.526	0.406
predicted recognition time (s)	56.0	51.8	48.2	46.0	40.4	33.4	31.6	24.4
measured recognition time (s)	57.9	51.9	48.7	29.5	48.4	13.4	17.2	28.5
standard deviation (s)	16.5	13.3	12.9	10.5	12.5	2.7	6.7	14.5
relative error(s)	-1.9	-0.1	-0.5	16.5	-8.0	20.0	14.4	-4.1

Fig. 6. Examples 43 - 50.

Example	43	44	45	46	47	48	49	50
predicted blindness	0.310	0.302	0.285	0.212	0.159	0.065	0.032	0.000
predicted recognition time (s)	18.6	18.1	17.1	12.7	9.5	3.9	1.9	0.0
measured recognition time (s)	46.5	25.3	8.6	21.9	6.5	10.7	16.2	7.2
standard deviation (s)	21.3	8.9	2.7	11	8.1	6.3	4.1	9.6
relative error(s)	-28.0	-7.2	8.5	-9.2	3.0	-6.8	-14.3	-7.2
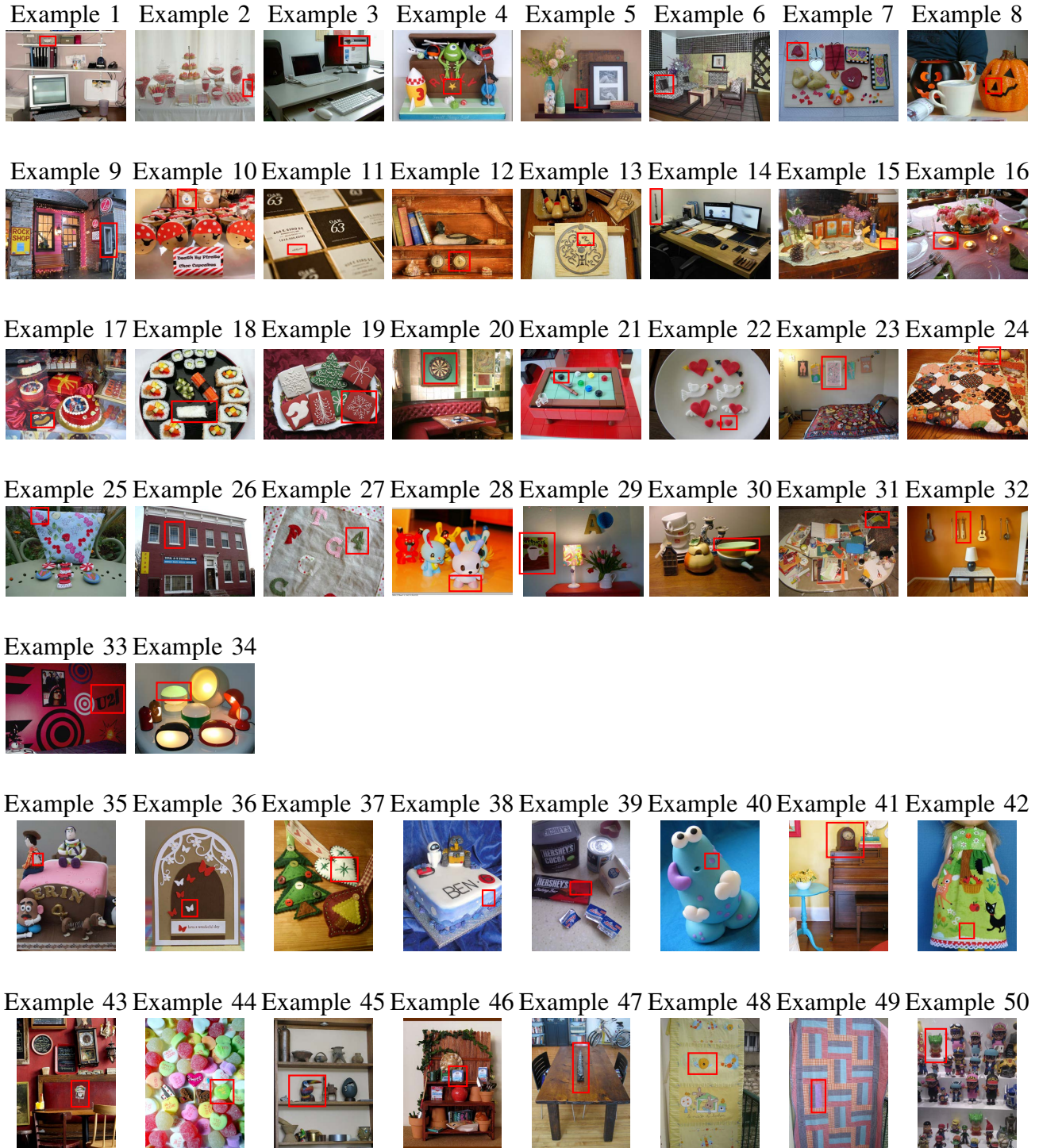
Fig. 7. Change locations in the training images of user study 1.

B. Testing Set

| | | original image | changed counterpart | | original image | changed counterpart |

Example	1	2	3	4	5	6	7	8	9	10
predicted blindness	0.961	0.944	0.939	0.937	0.920	0.862	0.848	0.847	0.810	0.799
predicted recognition time (s)	57.7	56.7	56.3	56.2	55.2	51.7	50.9	50.8	48.6	47.9
measured recognition time (s)	60	56.2	57	13.8	53.5	49.6	60	48.2	36	45
standard deviation (s)	6.9	14.7	15.7	4.6	21.2	19.2	0	17	7.4	13.8
relative error(s)	-2.3	0.4	-0.7	28.6	1.7	2.1	-9.1	2.6	12.6	2.9

Fig. 8. Examples 1 - 10.
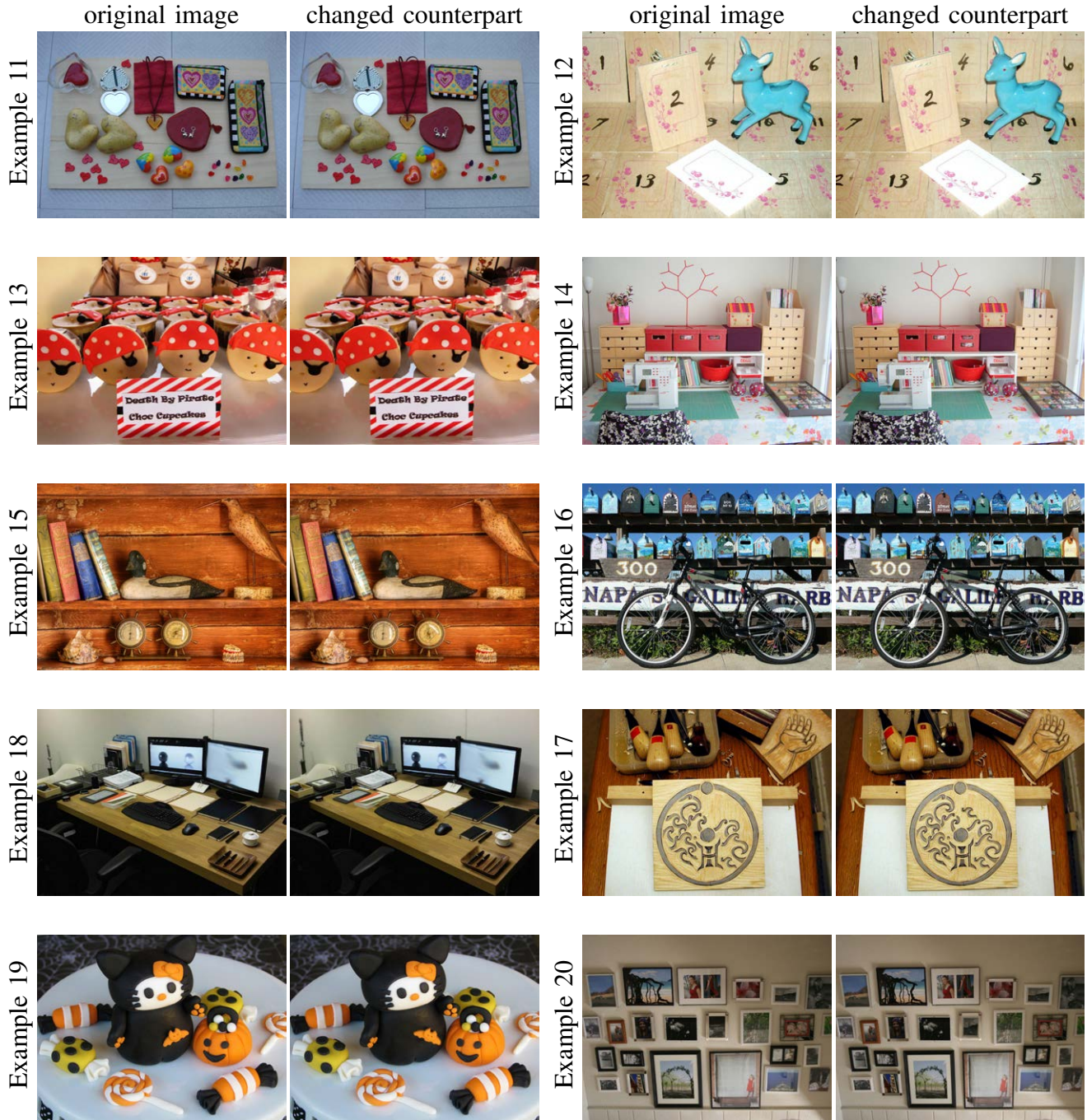
Example	11	12	13	14	15	16	17	18	19	20
predicted blindness	0.796	0.793	0.774	0.753	0.739	0.649	0.583	0.548	0.534	0.494
predicted recognition time (s)	47.8	47.6	46.4	45.2	44.3	38.9	35.0	33.0	32.0	29.6
measured recognition time (s)	42.4	20.8	46.1	45.1	41.4	30.5	19.5	33.3	21.9	51.6
standard deviation (s)	16.9	5.9	17.7	19.1	10.8	11.7	2.4	14.2	6.5	14.3
relative error(s)	5.4	26.8	0.3	0.1	2.9	8.4	15.5	0.4	10.1	-22.0

Fig. 9. Examples 11 - 20.
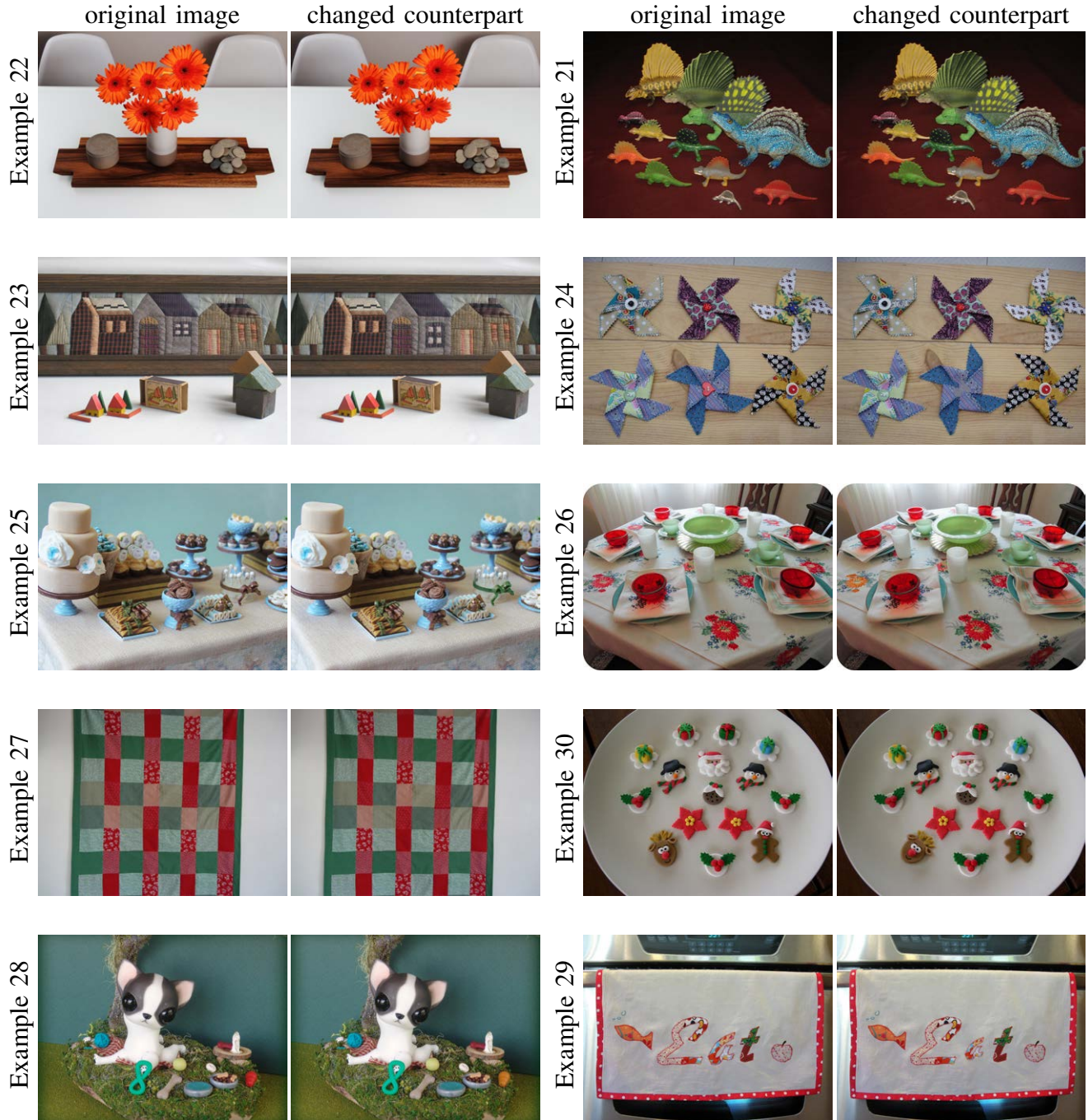
Example	21	22	23	24	25	26	27	28	29	30
predicted blindness	0.424	0.410	0.360	0.298	0.282	0.279	0.237	0.235	0.229	0.213
predicted recognition time (s)	25.4	24.6	21.6	17.9	16.9	16.7	14.2	14.1	13.7	12.8
measured recognition time (s)	27.2	60	25.4	9.1	9.1	33.4	45.6	16	7.8	5.3
standard deviation (s)	6.1	7	11.8	2.7	1.7	10.8	15.2	3.9	0.8	5
relative error(s)	-1.8	-35.4	-3.8	8.8	7.8	-16.7	-31.4	-1.9	5.9	7.5

Fig. 10. Examples 21 - 30.

Fig. 11.   Examples 31 - 35.
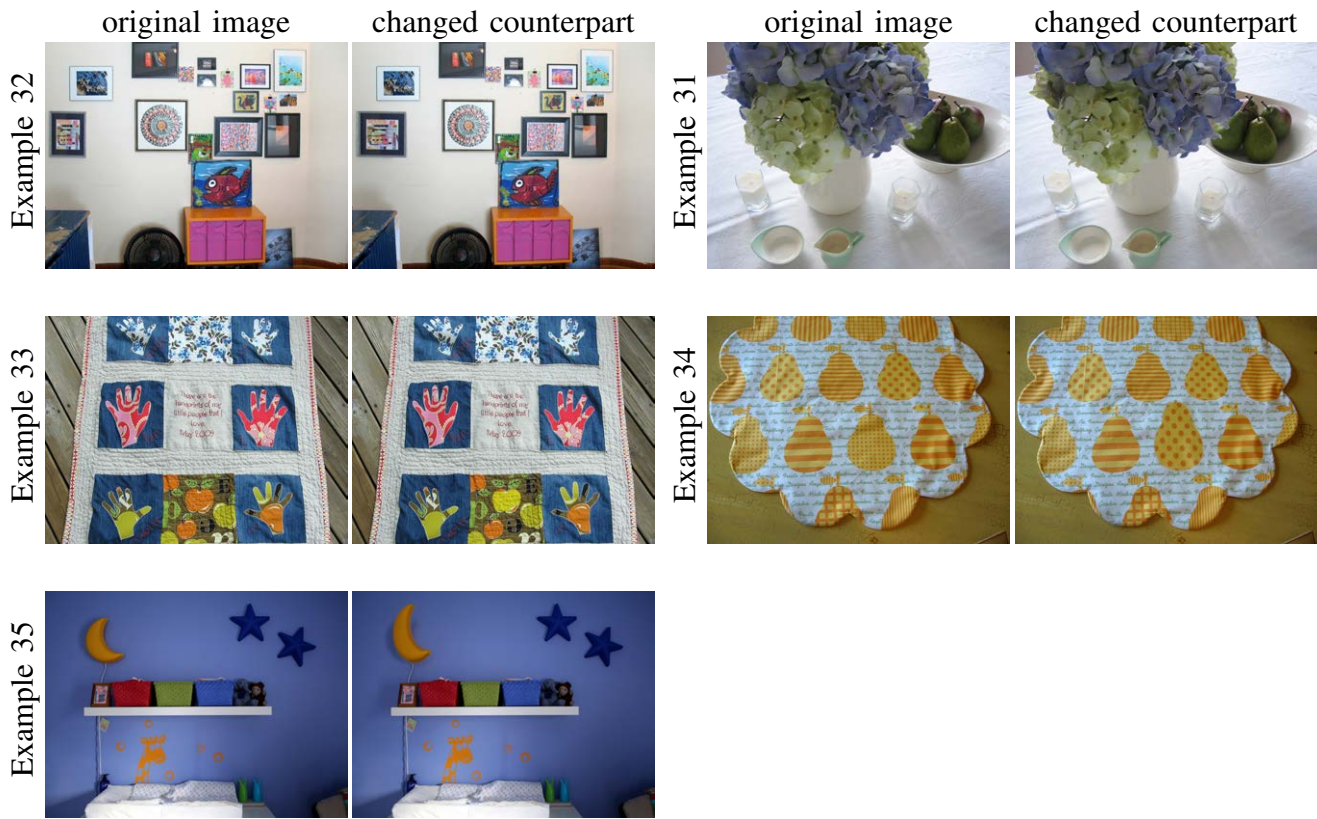
Example	31	32	33	34	35
predicted blindness	0.144	0.137	0.116	0.024	0.018
predicted recognition time (s)	8.6	8.2	7.0	1.4	1.1
measured recognition time (s)	13.3	43.9	19.3	5.8	14.4
standard deviation (s)	7.4	10	4.9	2.9	4.1
relative error(s)	-4.7	-35.7	-12.3	-4.4	-13.3

Example	36	37	38	39	40	41	42	43
predicted blindness	0.784	0.741	0.581	0.508	0.468	0.420	0.230	0.194
predicted recognition time (s)	47.0	44.5	35.0	30.5	28.1	25.2	13.8	11.6
measured recognition time (s)	60	10.8	19.3	15.1	28.5	36.4	5.9	4.4
standard deviation (s)	5.1	1.7	8.4	5.4	14.5	13.8	4.5	0.9
relative error(s)	-13.0	33.7	15.6	15.4	-0.4	-11.2	7.9	7.2

Fig. 12.   Examples 36 - 43.

Fig. 13. Examples 44 - 50.
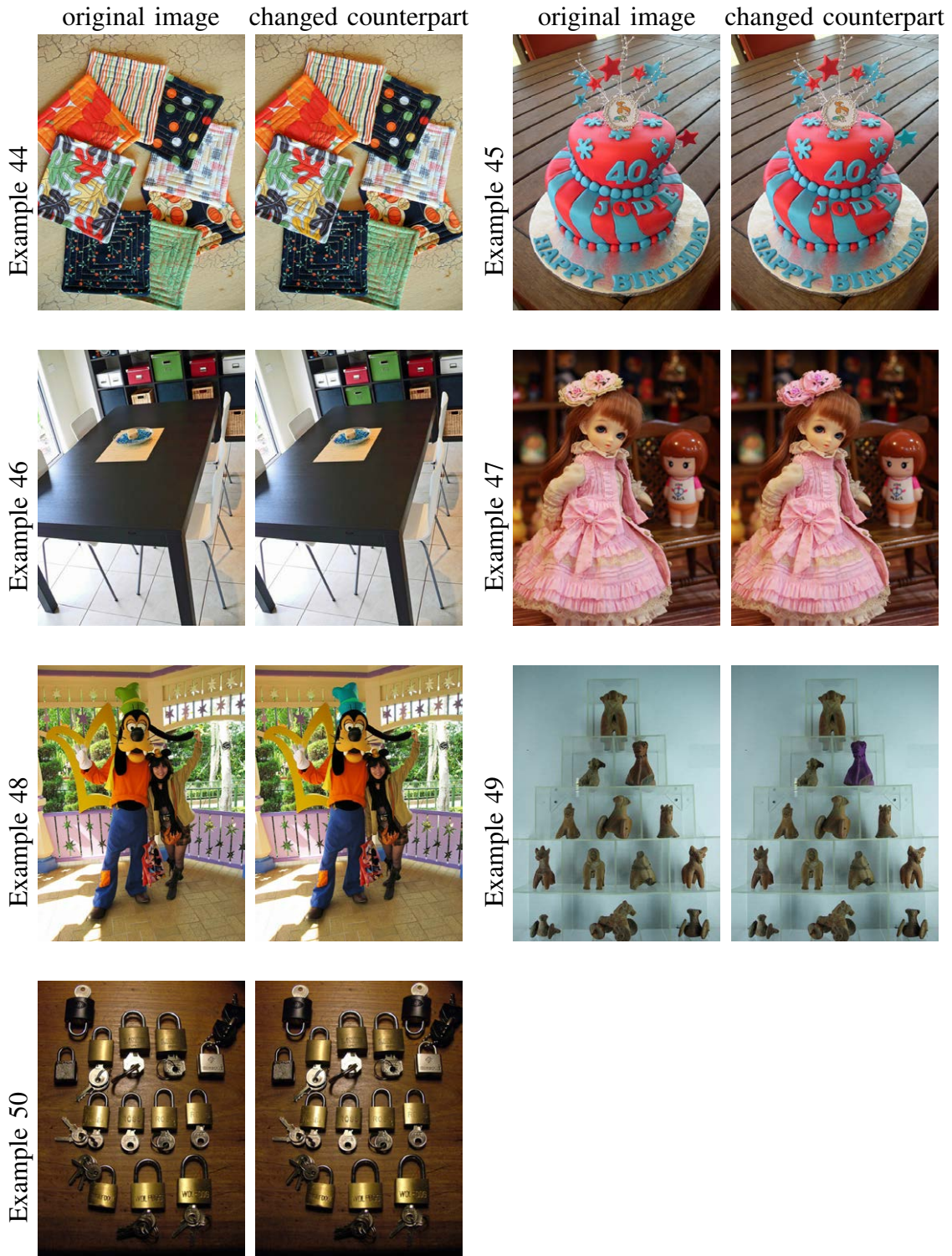
Example	44	45	46	47	48	49	50
predicted blindness	0.127	0.048	0.041	0.034	0.028	0.002	0.001
predicted recognition time (s)	7.6	2.9	2.5	2.0	1.7	0.1	0.1
measured recognition time (s)	37.2	18.5	17.2	6.5	7.9	2.2	24.2
standard deviation (s)	12.1	4.9	6.4	2	1.1	0.2	5.1
relative error(s)	-29.6	-15.6	-14.7	-4.5	-6.2	-2.1	-24.1

Example 1 Example 2 Example 3 Example 4 Example 5 Example 6 Example 7 Example 8

Example 9 Example 10 Example 11 Example 12 Example 13 Example 14 Example 15 Example 16

Example 17 Example 18 Example 19 Example 20 Example 21 Example 22 Example 23 Example 24

Example 25 Example 26 Example 27 Example 28 Example 29 Example 30 Example 31 Example 32

Example 33 Example 34 Example 35

Example 36 Example 37 Example 38 Example 39 Example 40 Example 41 Example 42 Example 43

Example 44 Example 45 Example 46 Example 47 Example 48 Example 49 Example 50
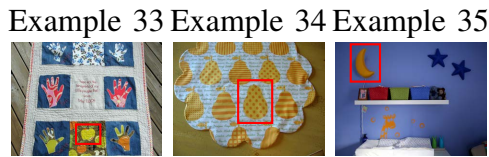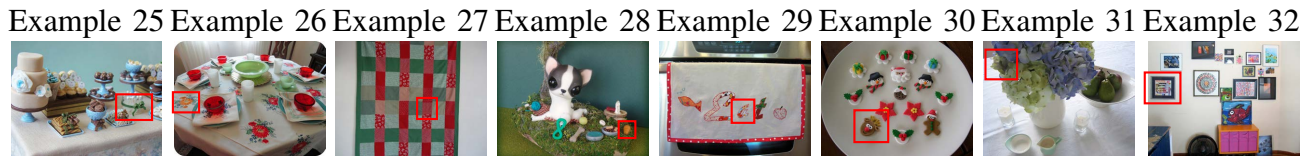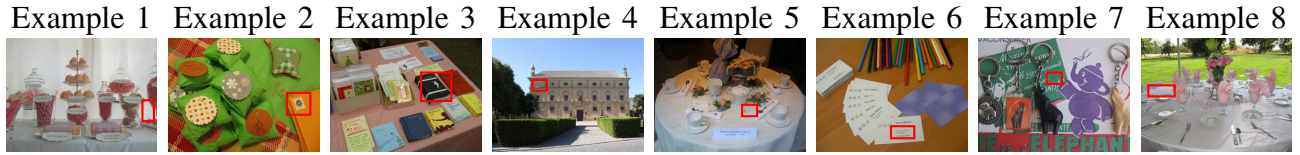

Fig. 14. Change locations in the testing images of user study 1.

II. USER STUDY 2

As said in the paper, we have modified 6 scenes, with 3 different difficulty levels, by setting desired blindness value B^* as $0.2, 0.5$ and 0.8, respectively. we provide all the 6 scenes, and the 18 generated changed counterparts. Change locations could be found in Figure 17.
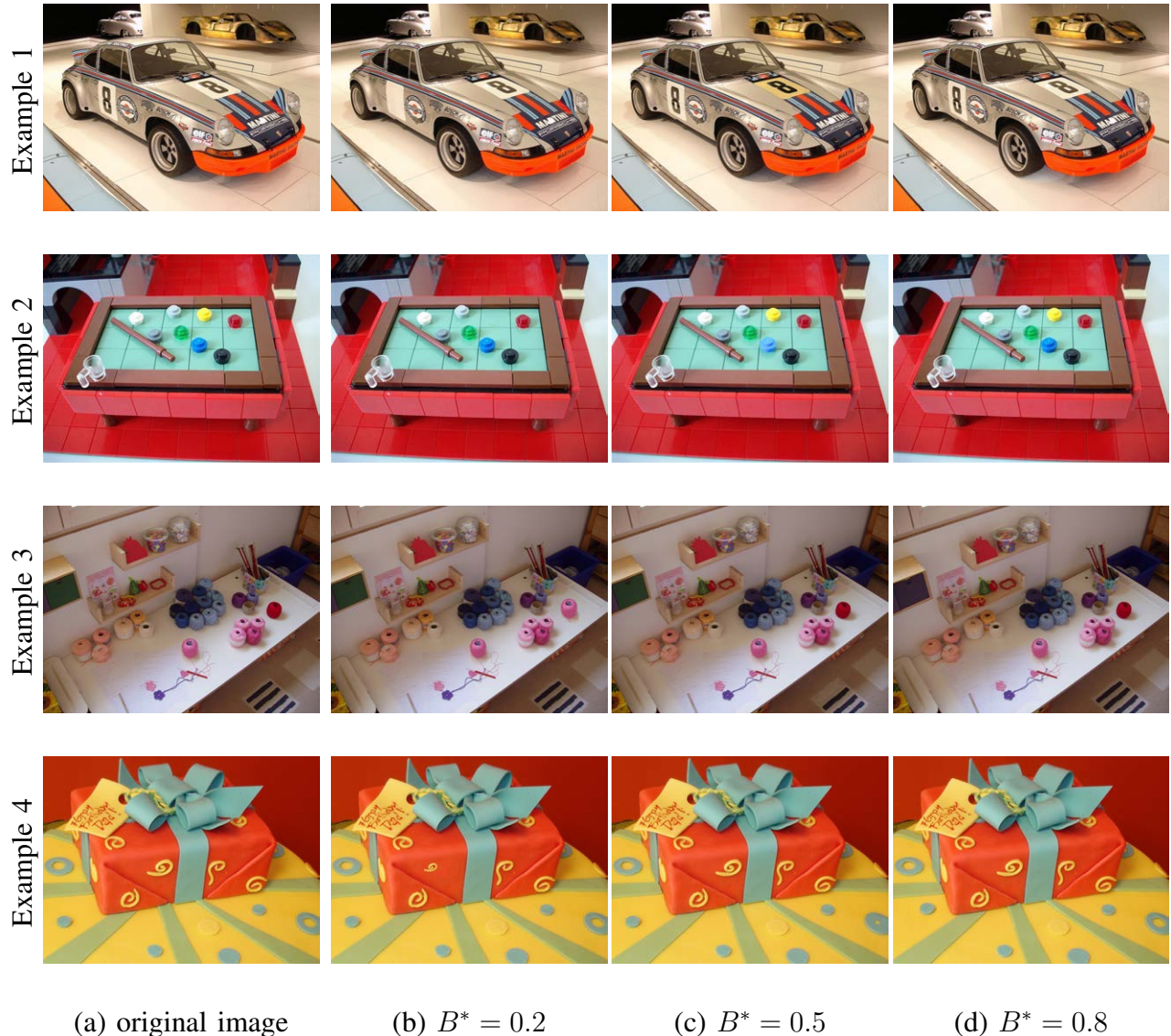

(a) original image   (b) $B^* = 0.2$ (c) $B^* = 0.5$ (d) $B^* = 0.8$

Fig. 15.   Examples 1-4.

(a) original image   (b) $B^* = 0.2$ (c) $B^* = 0.5$ (d) $B^* = 0.8$

Fig. 16. Examples 5-6.

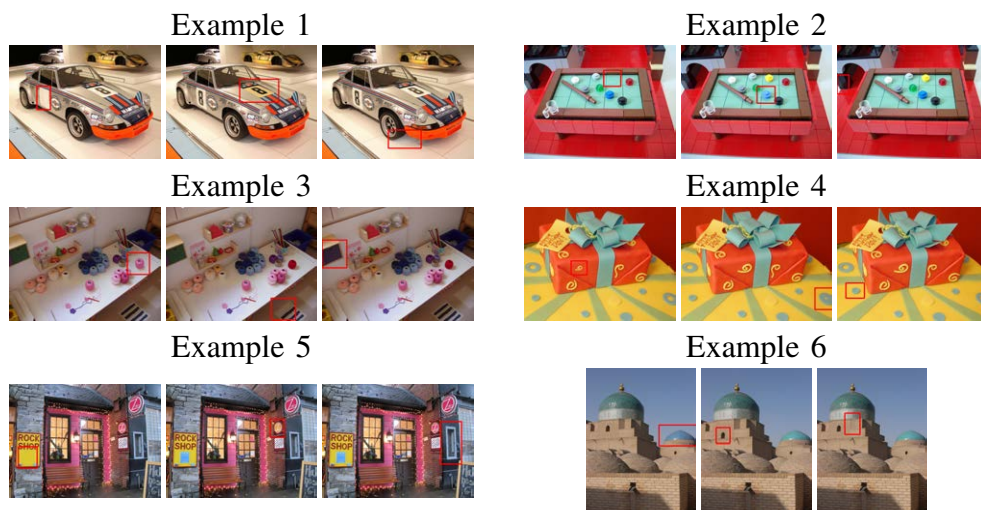| Example	1	2	3	4	5	6	average
recognition time (s)							
$B^* = 0.2$	8.7	19.6	21.9	16.8	13.1	10.0	15.0
$B^* = 0.5$	32.3	40.6	30.8	33.5	17.4	43.9	33.1
$B^* = 0.8$	57.4	48.9	39.5	40.9	38.7	58.5	47.3

TABLE I

RECOGNITION TIMES FOR ALL EXAMPLES.

Fig. 17. Change locations in the images of user study 2.