

Interactive Design of Gallery Walls via Mixed Reality

Supplementary Material

1 Templates

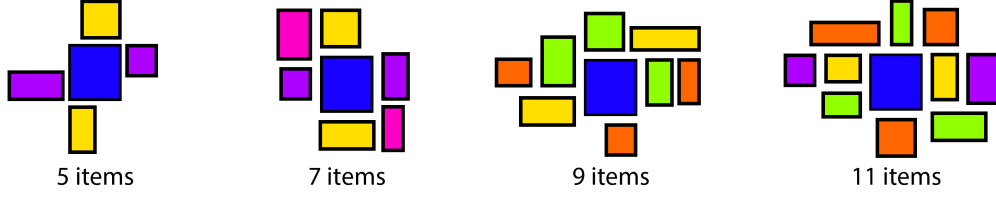


Figure 1: The templates we use in our system. The blue item represents the focal item. The colored items represent the groups of 2 or 3 auxiliary items.

2 Data Analysis

Table 1 shows the summary of performance results of Group 1 and Group 2. Table 2 shows the summary of usage statistics of Group 1 and Group 2. Individual data of all 41 participants can be found in the submitted Excel document **individual_data.xlsx**.

Performance Result: Group 1					Performance Result: Group 2				
		Mean	SD	p-value			Mean	SD	p-value
Number of Click	MR	39.88	11.77	<0.01	Number of Click	2D	38.67	20.14	<0.01
	2D	70.71	25.3			2DNT	55.04	35.60	
Number of Movements	MR	24.82	11.54	0.04	Number of Movements	2D	27.04	26.89	0.5
	2D	32.59	15.80			2DNT	22.80	39.6	

Table 1: Performance results of Group 1 and Group 2. MR refers to mixed reality, 2D refers to 2D interface with template, and 2DNT refers to 2D interface with no template.

Usage statistics: Group 1					Usage statistics: Group 2				
		Mean	SD	p-value			Mean	SD	p-value
Temp. Item Removed	MR	19.51%	17.89%	0.53	Temp. Item Removed	2D	25.37%	24.41%	N/A
	2D	28.19%	33.44%			2DNT	N/A	N/A	
Temp. Item Resized	MR	12.19%	15.53%	0.43	Temp. Item Resized	2D	6.82%	14.73%	N/A
	2D	7.67%	11.49%			2DNT	N/A	N/A	
Suggested Item Usage	MR	82.40%	19.85%	0.34	Suggested Item Usage	2D	75.27%	20.06%	<0.01
	2D	76.21%	24.83%			2DNT	59.84%	21.86%	
Select Item's Rank	MR	10.25	3.52	0.52	Select Item's Rank	2D	9.74	4.68	0.35
	2D	9.64	2.86			2DNT	8.67	3.69	

Table 2: Usage statistics of Group 1 and Group 2. MR refers to mixed reality, 2D refers to 2D interface with template, and 2DNT refers to 2D interface with no template.

3 User Study

To evaluate our approach, we conducted an IRB-approved user study with 41 participants. Group 1 was recruited to evaluate the user experience of designing a gallery wall using our mixed reality interface based on Magic Leap One versus using a 2D interface which mimics a traditional design tool on a laptop. We recruited 17 participants, consisting of 13 males and 5 females, aged between 20 to 45. Group 2 was recruited to evaluate the user experience of designing a gallery wall with and without the template functionality. We recruited 24 participants, consisting of 16 males and 8 females, aged between 19 to 24. The designs created by the participants can be found in the submitted document:

- **users_group1.html:** the designs created by Group 1.
- **users_group2.html:** the designs created by Group 2.

3.1 Comments from Group 1

All participants of Group 1 also gave comments after using our system. We summarized the comments as follows:

- Most participants liked the interactivity provided by the system.
- Most participants liked the immersiveness, the recommendations by our suggestion engine and the functionality to find compatible items.
- Most participants commented that the headset had a limited field-of-view. Some commented that it was a bit heavy to wear.
- Some participants disliked the auto-alignment function.
- Some participants preferred tags over recommendations because they had clear ideas what to look for.
- 2 participants suggested that it would be nice to be able to toggle auto-alignment, and to lock existing design before recommending new art items, and to select multiple or all art items to move together.
- 1 participant made a suggestion of creating a gallery wall using the desktop version of our tool, and then refining and visualizing the design using the mixed reality version of our tool.

4 Perceptual Study

We also evaluated the quality of the gallery wall designs created by the participants under different conditions. For this purpose we recruited an independent group of 88 participants, consisting of 40 males and 48 females aged 19 to 32, the average age was 23 . The participants were mostly university students and personnel. We asked them to rate the created designs following a two-alternative forced-choice approach.

Each perceptual study participant was presented with pairs of designs created by the same user evaluation participant under two different conditions (MR&2D or 2D&2DNT). The perceptual study participant was asked to choose one design within a pair he/she thought would better fit with the input living room shown in Figure 3. The two designs within a pair were shown on the screen in a random left-right order, and the order of the pairs presented to the perceptual study participant was also randomized.

Result Analysis. In total, we collected 3,608 ratings for 41 pairs of designs (88 ratings per pair). A design within a pair received one score if a perceptual study participant chose that design. Figure 2 shows the average scores of the designs created by the user evaluation participants under pairs of different conditions. Overall, there was no significant difference between the scores of the designs created under different pairs of conditions. We conclude that the visual qualities of the results created using our tool are similar whether our tool was used in mixed reality or on a 2D interface, and whether the template functionality was enabled.

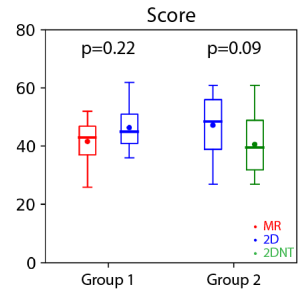


Figure 2: Perceptual study results.

5 2D Interface

Figure 3 shows the 2D user interfaces of our tool used in the user evaluation. It consists of three components: a) the *Design Canvas* which shows in the background a photo of the wall and the room captured from the real world, based on which the user designs a gallery wall. The user can interactively modify the current gallery design on the canvas; b) the *Template Panel* where the user can select and apply a preset template for synthesizing an initial gallery wall design; and c) the *Item Panel* where the user can retrieve art items from the database by specifying different criteria.

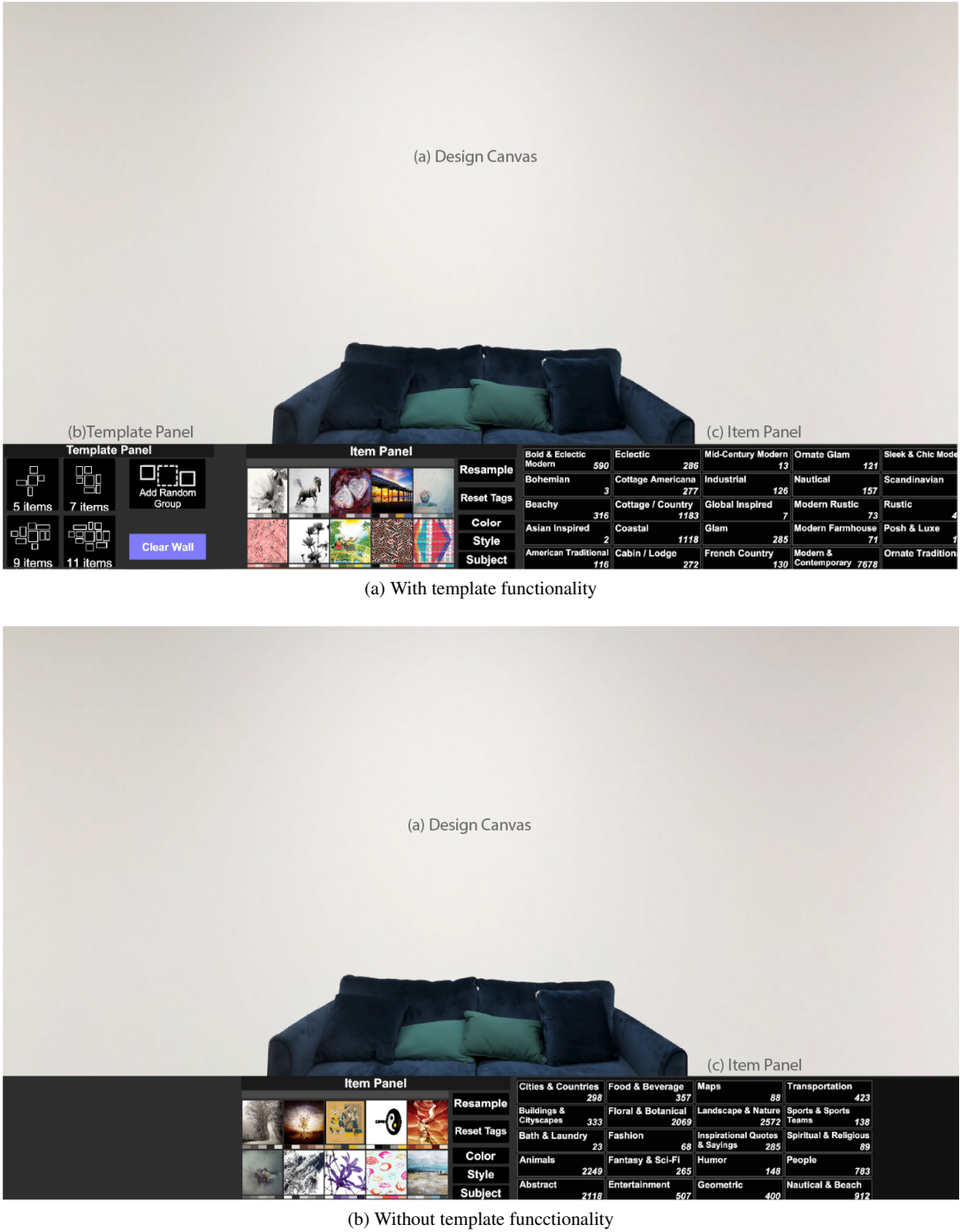


Figure 3: The 2D interfaces (a) with and (b) without the template functionality used in our user evaluation.