

# A STUDY OF RECOGNITION RATE FOR ICONS ON THE AUTO BIDET SEAT

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## ABSTRACT:

The purpose of this research is to investigate the recognition of icons used in Auto Bidet Seat. 9 function groups (Feminine Wash, Posterior Wash, Stop, Dryer, Heated Toilet Seat, Water Temperature, Water Amount, Massage and Baby Mode) of icons were classified by the functions, operation methods and the manuals of various Auto Bidet Seats. 65 volunteers were asked to fill in two questionnaires for the analysis of Confusion Matrix.

The results have shown that with or without prompting words, the recognition rate of icons for Feminine Wash, Posterior Wash and Stop were higher than 66.7% (ISO 7001:1990), however, for Dryer, Heated Toilet Seat, Water Temperature, Water Amount and Massage were lower than 66.7%. For Baby Mood, the recognition rate is lower than 66.7% with no prompting words but up to 80% with prompting words.

This research has shown that some existing icons of Auto Bidet Seats have consistent meaning between icons and their corresponding functions. However, there are still a lot of

icons confuse the users. These findings suggest that more efforts are needed for designing icons used in the Auto Bidet seats in order to facilitate the users.

**keywords: Confusion matrix, Icon, Recognition rate**

## 1. INTRODUCTION

The mankind toilet methods and the way of personal hygiene constantly are changing over time. The appearance of the stool turns the human posture adopted in moving bowels from the posture squatting down into a sitting posture. With the invention of Auto Bidet Seat, Instead of toilet paper, water is used for physiological clean. Therefore, personal hygiene has been improved, so has the ecosystem environment.

The Auto Bidet Seat provides a Washing Nozzle and a Bidet Nozzle featuring swirling water jets that give thorough cleanings for men and women after urinating or having bowel movements. The partial physiology sweeping feelings are such as whole body cleanness after bathing. The Auto Bidet Seat remains heated with a constant temperature all the times, so the breath-taking shock of sitting on a cold toilet seat in winter is eliminated, making it possible to use the toilet comfortably. In addition, the Auto Bidet Seat also has a massage effect which works as a suitable stimulus for improving the blood circulation or hemorrhoids.

Evolving quickly along with the technology, the form of the stool and Auto Bidet Seat are gradually presented with overall design. Regarding functions, in addition to the basic jet water washes and warm seat, some medium class products still have other derivative features such as Deodorizer, Warm Air Dry and Remote Control. Some high class products even have broadcast music attempting to give users a more relax atmosphere in the toilet environment. All the functions mentioned above are operating through buttons with icons on them. By their own understanding of the meaning of icons, users push the corresponding buttons to perform their desired functions. If the right button is pushed, the desired function will be performed. If the wrong button is pushed, an unexpected function will be performed. It might cause the user's body or mental state of unwell even dangerous. "Push the right button" is a key element in enjoying the advance of Auto Bidet Seat.

Most of the marketed Auto Bidet Seats have their own sets of icons and buttons representing functions to be performed. If the icons cannot be recognized by the users, wrong button would be pushed, and then unexpected function would be performed. Horton provided the icon design

characteristics as similarity, differentiation and importance. Preece (1993) stated that while designing icons, designers need to consider where and when to use the icons, the essence of the things and the differentiation from other icons. Foster (1990) simplified the icon design process into three stages of analyzing, developing and testing. However, among researches of sanitary equipments, the discussions on the operation interface of Auto Bidet Seat are rare to see. According to the reasons observed above, it is a necessity to carry on a further investigation of the operation interface of the evolving product.

The aim of this research is to study the recognition of icons used in Auto Bidet Seats for those who can complete the excreting movements and further explores whether the factors causing the variation of the accuracy exist or not.

## 2. METHOD

In order to reach the aim mentioned above, three stages were conducted. First, survey the functions and icons used in the marketed Auto Bidet Seats. Then classify them by the functions, operation methods and the manuals of various Auto Bidet Seats. Third, questionnaires in confusion matrix form were filled in by subjects. Recognition rates for each icon were calculated and z-tests against ISO standard were performed. Through analyzing icons with significant higher or lower recognition rate, the characteristic of better or worse icon design would be addressed.

### 2.1. PARTICIPANTS

70 volunteers were recruited. Among them, 41 are male, 29 are female. Average age is 19 years old. 15 of them had the experience in using Auto Bidet Seat. asked to fill in all the questionnaires for Confusion Matrix to know the correct rate and obscurity situation between functions, icons and prompting words.

### 2.3. QUESTIONNAIRE

Two kinds of questionnaires were used in this research. First questionnaire includes all the icons obtained from survey but no prompting words. Participants were asked to write down the meaning of each icon. The second one was presented in a confusion matrix. All icons randomly arranged in the top row, and their corresponding meanings in words are randomly arranged in the first column. Participants were asked to try to match the icons and their corresponding

meaning by checking the intersection cell.

### 3. RESULTS

After the collecting icons used in the marketed Auto Bidet Seats, 9 function groups (Feminine Wash, Posterior Wash, Stop, Dryer, Heated Toilet Seat, Water Temperature, Water Amount, Massage and Baby Mode) were classified by the functions, operation methods and the manuals of various Auto Bidet Seats. 55 icons were identified (Table 2-6, an Table 7-11).

140 (70 \* 2) questionnaires were returned. The valid questionnaires are 65 for each. The retrieving questionnaires were put in orders in a confusion matrix with text hint or without. An example of results is shown in Table 1.

Table 1: Feminine Wash – Confusion Matrix “Without” Text Hint

Icon \ Function																			
Recognition Rate (%)	67.7	80	13.8	64.6	16.9	63.1	52.3	63.1	29.2	78.5	53.8	72.3	64.6	36.9	6.2	66.2	32.3	35.4	23.1
Feminine Wash	44	52	9	42	11	41	34	41	19	51	35	47	42	24	4	43	21	23	15
Posterior Wash	0	0	46	12	29	0	15	0	6	0	10	2	2	21	9	2	30	17	39
Dryer	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stop	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Baby Mode	2	0	0	0	0	2	0	5	6	0	2	0	1	0	0	0	0	1	1
Heated Toilet Seat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
Water Temperatur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Amount	0	0	0	2	3	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Massage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	19	13	10	9	21	21	16	19	34	14	18	16	20	19	52	20	10	23	10
Total	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65

The standard icon recognition rate is 66.7% proposed by ISO 7001. At the 0.05 level of significance, the results of two-tailed z-test are shown in Table 2-11. Since  $-z_{0.025} = -1.96$ ,  $z_{0.025} = 1.96$ , in these tables, a “\*” after the value of  $z_0$  means the corresponding icon is significant in terms of recognition rate.

Table 2: Feminine Wash – “Without” Text Hint and  $Z_0$

Icon																			
$\hat{p}$	0.67	0.80	0.13	0.64	0.16	0.63	0.52	0.63	0.29	0.78	0.53	0.72	0.64	0.36	0.06	0.66	0.32	0.35	0.23
$Z_0$	0.17	2.29*	-9.11*	-0.35	-8.58*	-0.62	-2.48*	-0.62	-6.46*	2.03*	-2.21*	0.96	-0.35	-5.13*	-10.44*	-0.09	-5.93*	-5.39*	-7.52*

Table 3: Posterior Wash –“Without” text hint , Recognition Rate and  $Z_0$

Function \ Icon													
Recognition Rate (%)	73.8	78.5	56.9	78.5	72.3	81.5	58.5	52.3	76.9	63.1	6.2	50.8	72.3
Posterior Wash	48	51	37	51	47	53	38	34	50	41	4	33	47
$Z_0$	1.23	2.03*	-1.69	2.03*	0.97	2.56*	-1.42	-2.48*	1.76	-0.63	-10.44*	-2.75*	0.97

Table 4: Dryer –“Without” text hint , Recognition Rate and  $Z_0$

Function \ Icon									
Recognition Rate (%)	32.3	47.7	38.5	44.6	30.8	58.5	18.5	29.2	
Dryer	21	31	25	29	20	38	12	19	
$Z_0$	-5.93*	-3.28*	-4.87*	-3.81*	-6.20*	-1.42	-8.32*	-6.46	

Table 5: Stop –“Without” text hint , Recognition Rate and  $Z_0$

Function \ Icon							
Recognition Rate (%)	75.4	83.1	75.4	100	58.5	73.8	87.7
Stop	49	54	49	65	38	48	57
$Z_0$	1.50	2.82*	1.50	5.74*	-1.42	1.23	3.62*

Table 6: Baby Mode , Heated Toilet Seat , Water Temperature , Water Amount and Massage –“Without” text hint , Recognition Rate and  $Z_0$

Function \ Icon								
Recognition Rate (%)	61.5	33.8	9.2	24.6	40	7.7	0	0
Baby Mode	40	0	2	0	0	0	0	0
Heated Toilet Seat	0	22	6	0	0	0	1	0
Water Temperature	0	3	0	16	26	0	0	0
Water Amount	0	0	0	0	0	5	0	1
Massage	0	0	0	0	0	0	0	0
$Z_0$	-0.89	-5.66*	-9.91*	-7.26*	-4.60*	-10.17*	-11.50*	-11.50*

Table 7: Feminine Wash –“With” text hint, Recognition Rate and Z<sub>0</sub>

Icon \ Function																				
Recognition Rate (%)	73.8	98.5	18.5	60	18.5	46.2	52.3	50.8	44.6	58.5	81.5	73.8	93.8	0	92.3	58.5	50.8	29.2	69.2	
Feminine Wash	48	64	12	39	12	30	34	33	29	38	53	48	61	0	60	38	33	19	45	
Z <sub>0</sub>	1.23	5.48*	-8.32*	-1.155	-8.32*	-3.54*	-2.48*	-2.75*	-3.81*	-1.420	2.56*	1.23	4.68*	-11.50*	4.42*	-1.420	-2.75*	-6.46*	0.44	

Table 8: Posterior Wash – “With” text hint, Recognition Rate and Z<sub>0</sub>

Icon \ Function														
Recognition Rate (%)	87.7	80	66.2	86.2	83.1	55.4	52.3	10.8	26.2	76.9	64.6	66.2	61.5	
Posterior Wash	57	52	43	56	54	36	34	7	17	50	42	43	40	
Z <sub>0</sub>	3.62*	2.29*	-0.09	3.35*	2.82*	-1.95	-2.48*	-9.64*	-6.99*	1.76	-0.36	-0.09	-0.89	

Table 9: Dryer –“With” text hint , Recognition Rate and Z<sub>0</sub>

Icon \ Function								
Recognition Rate (%)	41.5	35.4	32.3	46.2	50.8	27.7	26.2	33.8
Dryer	27	23	21	30	33	18	17	22
Z <sub>0</sub>	-4.34*	-5.40*	-5.93*	-3.54*	-2.75*	-6.73*	-6.99*	-5.66*

Table 10: Stop –“With” text hint , Recognition Rate and Z<sub>0</sub>

Icon \ Function							
Recognition Rate (%)	76.9	89.2	52.3	84.6	93.8	80	83.1
Stop	50	58	34	55	61	52	54
Z <sub>0</sub>	1.76	3.89*	-2.48*	3.09*	4.68*	2.29*	2.82*








Table 11: Baby Mode , Heated Toilet Seat , Water Temperature , Water Amount and Massage –“With” text hint , Recognition Rate and Z<sub>0</sub>









Icon \ Function								
Recognition Rate (%)	80	32.3	53.8	44.6	49.2	15.4	1.5	0
Baby Mode	52	0	0	0	0	0	0	
Heated Toilet Seat	0	21	35	12	15	0	1	4
Water Temperature	0	2	10	29	32	0	0	1
Water Amount	0	3	1	1	0	10	1	3
Massage	0	0	0	0	0	0	0	0
Z <sub>0</sub>	2.29*	-5.93*	-2.22*	-3.81*	-3.01*	-8.85*	-11.24*	-11.50*





## 4. DISCUSSION

This research carried out the analysis and investigation of the characteristics of icons used in






Auto Bidet Seats. Some interesting findings and their implication for icon design are addressed in the follows.

In Feminine Wash group, the recognition rate of the icons , ,  and  were all over 66.7%. Obviously, the 4 icons have clear patterns of woman and with color pink of the three. These characteristics made the users link the function and meaning of the icons very easily. Although the icons  have pink characteristic, the direction of water jets is not match to the physiological feature of women. Over 70% of the users think that the icon  represents the function of Posterior Wash. The icon  is another failed work with the lowest recognition rate 6.2%. It is not easy to make users to relate the pattern flower with the function of Feminine Wash.


In Posterior Wash group, the recognition rates of ,  and  are all pretty high with or without the text hint. They all have a forward spout flush which is easier to relate them with the back flushing. Other icons like  and  express the function of flushing bottoms by spout clearly which is the essential when designing these kinds of icons. On the contrary, like , there is only a spout flushes up which does not show out flushing forward, easier to get confused even with the text hint. Same as  and , it is possible to get confused with the amount of water flushing out, low or high. According to these, the design characteristics of the icons of back cleaning are the spout flushing forward and the distinct bottom.








In Dryer group, it can be seen that the picture of fans helps the recognition, such as . It is also important to show out clearly where the part should be dried, like . Yet,  and  could be confused with the flow which belong to the worse design characteristics.

In the icons of Stop group, the recognition rates are mostly high with or without text hint.

According as the highest two:  and , the design characteristic is that there is text label within the icon, so actually they have the text hint originally. It is a characteristic of design which can be referred to. Moreover, the recognition rate of  and  are also pretty high. Mostly due to the icon like this is already means “stop” in daily life. At last, the icon like  has the lowest recognition rate. At first glance, it got not much difference with other icons. The only important difference is a circle within the middle, while others are squares. According to this,

the inference would be that whether it is circle or square within could affect people's acknowledgement. This could be inferred as the basis when designing these sorts of icons.

In Baby Mode group,  was the only one founded during the market survey. It seems like an high recognition rate icon, and it truly is. Therefore, in this research we suggest people infer the original design characteristics for Baby Mode.

About the icons of Heated Toilet Seat group and Water Temperature group, , ,  and  could be compared by the variation of recognition rate. The icons with thermometer were thought to have a higher chance to be related with temperature. Therefore the characteristics of the design are that the elements which are strongly related with temperature, Heated Toilet Seat or water temperature are necessary. In the icons which indicate the low amount water, are mostly low recognition rate, such as  and . These two are easier to get confused with the icon of flushing or high amount water; consequently, designers should notice to avoid these kinds of design. Moreover, look for the new design characteristics which must let people associate the function of low amount water in thinking. In the case of massage function, the market survey found only one icon . After the investigation and analysis of the icon, the design characteristics were founded to be similar with the baking flash icon which is easy to be confused. Therefore, the use of the characteristics like waves should be avoided.

## 5. CONCLUSION

In the age of global village, icons have to be good media of communication because the culture, language and words of some areas are different from others. With the increases of contents and complexity of new products, it is not easy to design ideal icons for users to recognize the delicate functions. Though Auto Bidet Seat has already presented for decades on the market, many function icons, even the icons with text hint, still puzzle users. This research showed the present situation of function icon design on Auto Bidet Seat. These findings suggest that more efforts are needed for designing icons used in the Auto Bidet seats in order to facilitate the users. Hopefully, the results would be a good reference for designers in designing related interface and would get more researchers to put efforts in this area.

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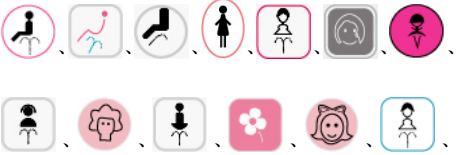
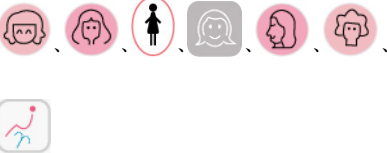




















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Table 12: Icons with Significant Recognition Rate.

Function	Text hint	Greater than 66.7%	Smaller than 66.7%
Feminine Wash	Without		
	With		
Posterior Wash	Without		
	With		
Dryer	Without	None	
	With	None	
Stop	Without		
	With		
Baby Mode	Without	None	
	With		None
Heated Toilet Seat	Without	None	
	With	None	
Water Temperature	Without	None	
	With	None	
Water Amount	Without	None	
	With	None	
Massage	Without	None	
	With	None	