A Study on Aging Group's Color Association with the Categories of the Commodities

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Abstract: Some data in the elderly has been reported that the degeneration of the senses makes them difficult to live safely, independently and individually. For instance, the elderly may always try so hard to search for some important commodities that can be caused by their worse memory. It could even make elderly people feel very frustrated. Therefore, the purpose of this study is to explore the aging group's associative linkage between the categories of some commodities and specific colors for further applying to plan the colors of storage cabinets in the nursing home. So that the specific colors can be the reminders for elderly people to find the places they have stored the articles in and to reduce their memory load. For the purpose, the study conducted a questionnaire survey with 89 elders (mean age=61.5) to see the aging group's color association with the categories of the commodities. The main findings are: firstly, the elderly did not influenced by the inherent color of each commodity to select an associated color as we adopted the categories of the daily use articles to be the associated objects. Secondly, to the elderly, bright and vivid colors are easier to be picked up than the colors with low degree of lightness and chroma caused by their poor vision. On the contrary, include black, there is no difference between the dark colors with various hues to elderly people. That is, the elderly could not identify the dark colors with different hues and would not like to pick up them from the color samples for being the associative color with any category of the commodities. In other words, the darker colors are inappropriate to be considered about in storage cabinets' color plan for storing the elders' commodities.

Keywords: color association, color cognition, aging group, storage cabinet

1. Introduction

Population aging has become a global issue in recent years because of drops in birth rates and extensions of longevity. The population of Taiwan has been classified as an aging society since 1993. The elderly group is an important social resource rich in knowledge and experience, and increasing efforts are being invested into elder-related research. Body function degeneration issues in the elderly can be primarily categorized into the three areas of motion, perception and cognition (Lee, 2001). The present study investigated an issue that is closely related to the perception and cognition functions. The investigated bodily functions included perception functions such as vision, hearing and touch, and cognitive functions such as comprehension, memory and decision-making. Vision deterioration and memory loss are the most frequently observed phenomena among the elderly (Hawthorn, 2000; Kausler *et al*., 1985), and the current study specifically explored memory loss and vision deterioration issues in

senior citizens. The association between the household goods category and color matching was also determined. Color associations could potentially be employed to ease the memory burdens of the elderly and help them to easily find the locations of various items.

In an effort to determine whether the elderly age group holds particular associations of colors with different household good categories, the current study attempted to understand the colors that come to mind in the elderly group when they see different household goods. Therefore, the aims of the current study were (1) to identify the corresponding colors associated with different categories of commodities; and (2) to determine the colors not associated with household goods or storage spaces.

2. Method

The aim of the current study was to determine the color associations corresponding to categories of the commodities and storage spaces, and questionnaire surveys and statistical analysis were conducted using questionnaires A and B. The colors associated by the elders with various categories were confirmed using the results of questionnaires A and B. The detailed research methodology is described below:

2.1 Subjects

The World Health Organization defines an elderly person as an individual older than the age of 65. However, different Asian countries hold different views toward the elder group. The three nations commonly define an elderly person as one aged above 55 (Chou, 2007) even though the age definitions for elderly groups are different in Taiwan, Japan, and Korea. Therefore, the subjects of the study were 89 individuals (47 males and 42 females) above the age of 55. The mean age of the group was 61.5 years old. A detailed distribution of those subjects' ages is shown in Table 1:

Table 1. Age distribution

Range of age	55~59	60~64	65~69	70~74
Number of subjects	38	26	15	10

2.2 Content of questionnaire

The categories of the commodities were narrated verbally to the subjects to avoid the influence of color in graphic representations, and a selection of colors was offered to the subjects for selection. Questionnaire A (Figure 1) allowed study subjects to select colors which they associated with different categories of the commodities; questionnaire B allowed study subjects to choose colors which they deemed to not be associated with any categories of the commodities.

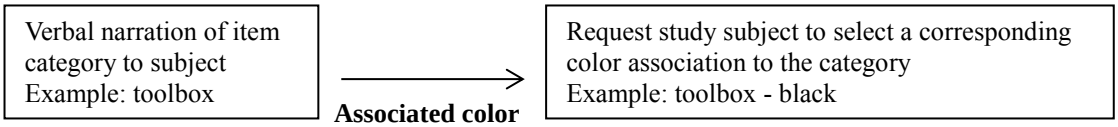


Figure 1.Questionnaire A

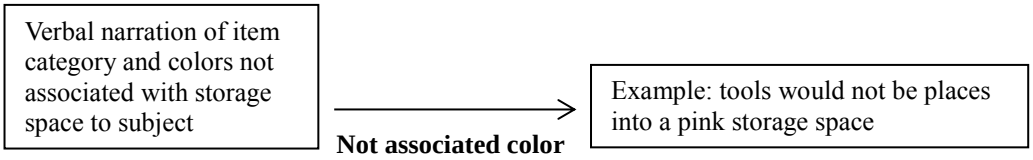


Figure 2. Questionnaire B

2.3 Study samples

The 11 basic colors mentioned by Berlin & Kay (1969) were selected as the color sample in this study. The color sample was displayed on an iPad in a block area of 1.7 x 1.7 cm (Figures 3 & 4), and the colors included were yellow, orange, red, pink, purple, blue, green, brown, grey, black and white. Color selection was performed using the CIELab color system, which included 72 chromatic colors and 6 achromatic colors, totaling 78 selections.

The L*, C* and hue values of all color samples were within the range shown in Figure 2 (Lin et al. 2001). Lightness (L*) and chroma (C*) distinctions of the chromatic colors red, orange, blue, green and purple were selected using a range of ±15; the specific lightness of yellow, brown and pink led to the use of ranges ±5, ±7 and ±10, respectively, for the distinction selection of L* and C* for the 3 colors. Achromatic colors were selected using the mean value of black, white and grey.

Table 2. L*, C* and hue value ranges of the 11 basic colors (Lin *et al*., 2001)

	≤ L*>		≤ C^*_{ab}>		≤ h_{ab}>	
White (W)	100	90	5	0	—	—
Grey (Gy)	90	40	5	0	—	—
Black (Bl)	40	0	5	0	—	—
Brown (Br)	60	29	44	5	25	80
Pink (Pk)	100	60	50	5	340	65
Yellow (Y)	100	71	—	—	65	100
Red (R)	—	—	—	—	10	40
Orange (O)	—	—	—	—	40	66
Green (G)	—	—	—	—	66	196
Blue (Bl)	—	—	—	—	196	290
Purple (P)	—	—	—	—	290	10

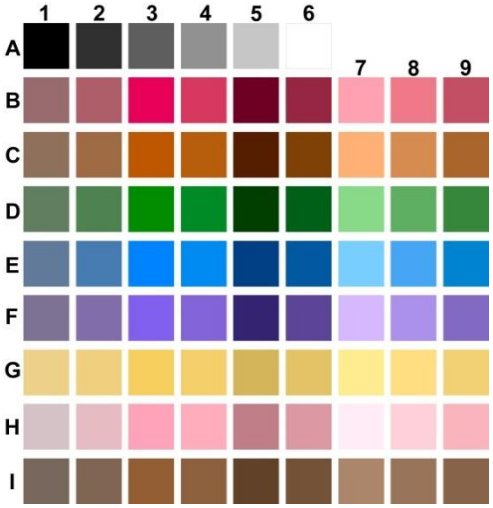


Figure 3. Color sample

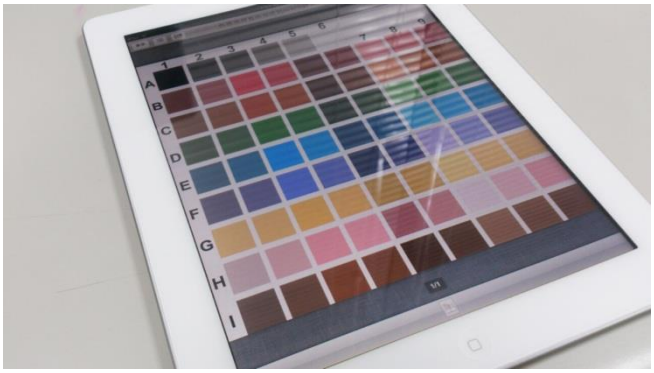


Figure 4. Color sample as shown using an iPad

2.4 Environment of experiment

Ambient light at location of experiment was not limited and the color temperature ranged between 5500K – 6500K. The 89 subjects each experienced an average ambient light of 729lux and color temperature of 6248K.

3. Results and Discussions

3.1. Analysis of questionnaire A

The survey results of questionnaire A revealing the elderly group's association of colors with ten household good categories are shown below (See Table 3 for more details):

(1) Certificates and documents: The most selected color sample was A1, which accounted for 23.8% of all selections; the second most selected was A2, which accounted for 11.9% of all selections; the next most selected was A5, which accounted for 8.8% of all selections.

(2) Clothing and accessories: The most selected color sample was E3, which accounted for 15% of all selections; the second most selected were B3 and H7, each of which accounted for 11.3% of all selections; the next most selected were H3 and H7, which combined to account for 6.3% of all selections.

(3) Personal belongings: The most selected color samples were C5, which accounted for 12.6% of all selections; the second most selected was A1 and I5, each of which accounted for 11.3% of all selections; the next most selected were B3, which accounted for 8.8% of all selections.

(4) Keys: The most selected color sample was A5, which accounted for 18.8% of all selections; the second most selected was A4, which accounted for 12.5% of all selections; the next most selected was A1, which accounted for 8.8% of all selections.

(5) IT products: The most selected color sample was E7, which accounted for 18.8% of all selections; the second most selected was E3, which accounted for 11.3% of all selections; the next most selected was F7, which accounted for 8.8% of all selections.

(6) Household appliances: The most selected color sample was B3, which accounted for 18.8% of all selections; the second most selected were D3 and A6, each of which accounted for 8.8% of all selections; the next most selected was E3, which accounted for 7.5% of all selections.

(7) Household hardware: The most selected color sample was A1, which accounted for 27.5% of all selections; the second most selected was A2, which accounted for 15% of all selections; the next most selected was D5, which accounted for8.8% of all selections.

(8) Medical products: The most selected color sample was A6, which accounted for 33.3% of all selections; the second most selected was B3, which accounted for 16.3% of all selections; the next most selected was H7, which accounted for 10% of all selections.

(9) Stationery: The most selected color sample was C3, which accounted for 12.5% of all selections; the second most selected were C5 and H3, each of which accounted for 10% of all selections; the next most selected was E3, which accounted for 7.5% of all selections.

(10) Kitchenware: The most selected color sample was A5, which accounted for 15% of all selections; the second most selected was A4, which accounted for 10% of all selections; the next most selected was I5, which accounted for 7.5% of all selections.

Table 3. Statistical analysis of associated color selection

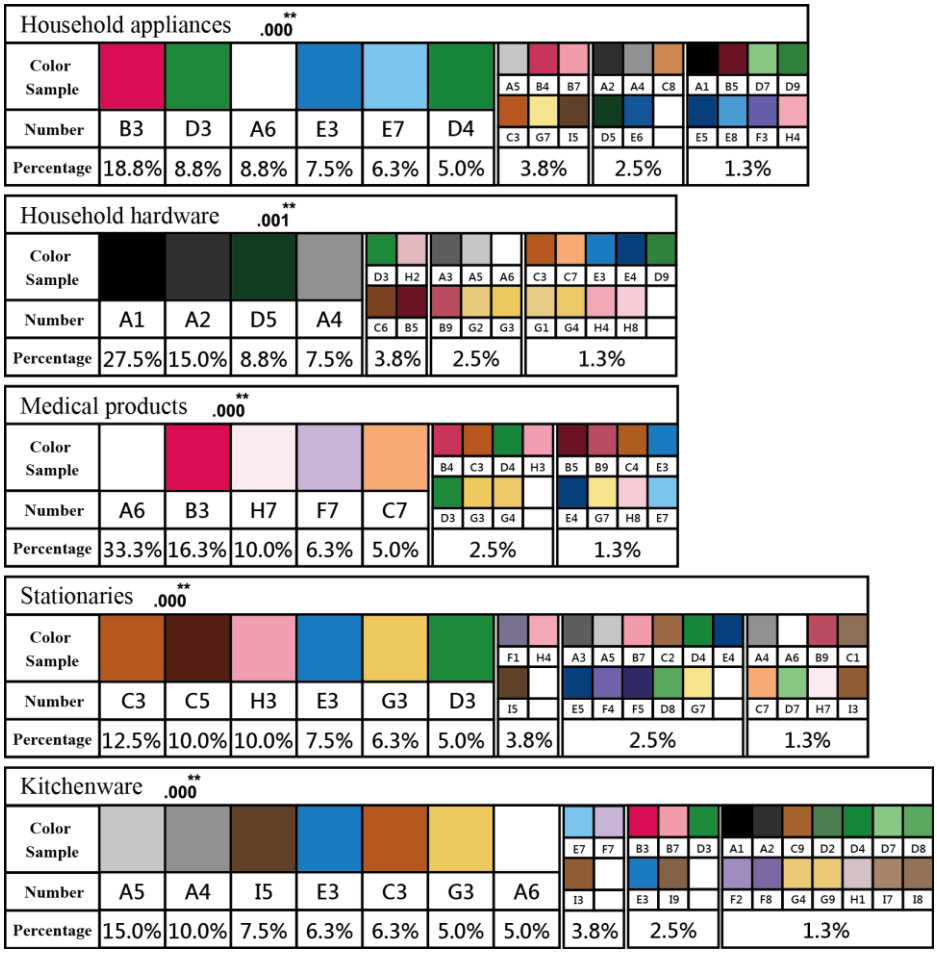
Certificates and documents .000**																					
Color Sample							H1	D4	A1	E3	G2	C7	B5	B8	D5	D7	F3				
Number	C3	B3	A5	C5	D3	H3	E9	E5	H7	A6	G7		E4	E8	I2	I5					
Percentage	18.8%	16.3%	8.8%	6.3%	6.3%	5.0%	2.5%						1.3%								

Clothing and accessories .000**																					
Color Sample							B4	B7	D3	C2	C9		A4	A5	A6	B8	C1	C3	C5		
Number	E3	B3	E7	H3	H7	G3	D7	F3		E9	F7		C6	C7	F9	G5	I3	I6			
Percentage	15.0%	11.3%	11.3%	6.3%	6.3%	5.0%	3.8%			2.5%			1.3%								

Personal belongings .000**																					
Color Sample								A2	C7	D3			B6	E5		A6	C1	C4	D4		
Number	C5	A1	I5	B3	C3	B5	H7	E3	E8				I9	G4		F5	G7	H3	H4		
Percentage	12.6%	11.3%	11.3%	8.8%	6.3%	6.3%	5.0%	3.8%					2.5%			1.3%					

Keys .000**																					
Color Sample								A6	B2	B5			E3	H2		B7	C9	D3	D7	D9	
Number	A5	A4	A1	D4	I4	H7	F3	C3	I3				G3			E4	F7	G2	H3		
Percentage	18.8%	12.5%	8.8%	6.3%	5.0%	5.0%	5.0%	3.8%					2.5%			1.3%					

IT products .000**																					
Color Sample					A6	G3	B1	A3	C7	D7	A1	B4	B7	B9	C2	E5					
Number	E7	E3	F7	A5	F3	F5	E9	E4	H1	H7	E6	F1	G8	H3	I5	I9					
Percentage	18.8%	11.3%	8.8%	6.3%	3.8%			2.5%			1.3%										



3.2 Analysis of questionnaire B

The survey results of questionnaire B revealing colors not associated with storage space and household good categories are shown below (See Table 4 for more details):

(1) Certificates and documents: The most selected color sample was A1, which accounted for 24% of all selections; the second most selected was A2, which accounted for 12% of all selections; the next most selected was E5, which accounted for 7.2% of all selections.

(2) Clothing and accessories: The most selected color sample was A1, which accounted for 19.2% of all selections; the second most selected was I5, which accounted for 14.4% of all selections; the next most selected was A2, which accounted for 9.6% of all selections.

(3) Personal belongings: The most selected color sample was A6, which accounted for 16.8% of all selections; the second most selected was H7, which accounted for 12% of all selections; the next most selected was B3, which accounted for 7.2% of all selections.

(4) Keys: The most selected color sample was A1, which accounted for 13.2% of all selections; the second most selected was D5, which accounted for 9.6% of all selections; the next most selected was C5, which accounted for 8.4% of all selections.

(5) IT products: The most selected color sample was A1, which accounted for 12% of all selections; the second most selected was D5, which accounted for 9.6% of all selections; the next most selected was F5, which accounted for 6% of all selections.

(6) Household appliances: The most selected color sample was A1, which accounted for 14.4% of all selections; the second most selected was B5, which accounted for 10.8% of all selections; the next most selected were A1 and D5, each of which accounted for 6% of all selections.

(7) Household hardware: The most selected color sample was A6, which accounted for 15.6% of all selections; the second most selected was E3, which accounted for 10.8% of all selections; the next most selected was H7, which accounted for 7.2% of all selections.

(8) Medical products: The most selected color sample was A1, which accounted for 21.6% of all selections; the second most selected was A2, which accounted for 12% of all selections; the next most selected was F5, which accounted for 6% of all selections.

(9) Stationery: The most selected color sample was A1, which accounted for 13.2% of all selections; the second most selected were I1 and I5, each of which accounted for 7.2% of all selections; the next most selected were B5 and D5, each of which accounted for 6% of all selections.

(10) Kitchenware: The most selected color sample was A1, which accounted for 12% of all selections; the second most selected was D5, which accounted for 8.4% of all selections; the next most selected was E5, which accounted for 7.2% of all selections.

Table 4. Statistical analysis of not associated color selection

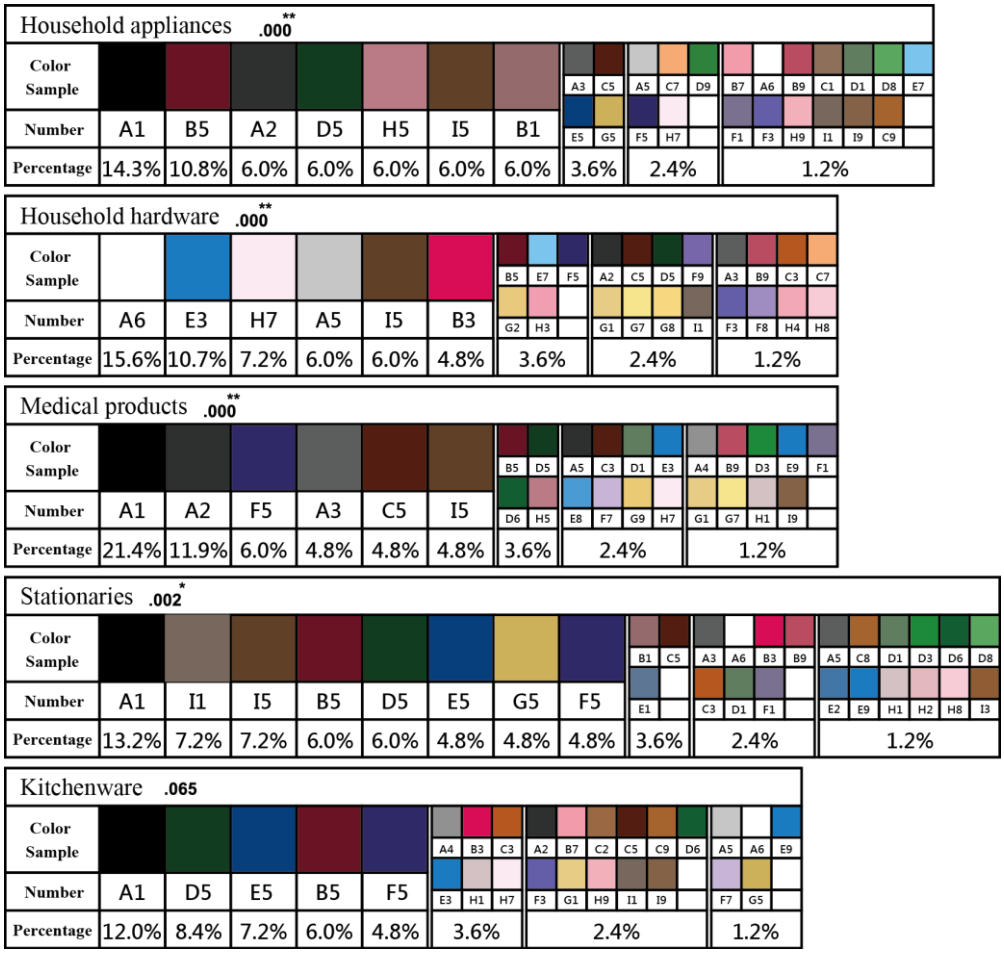
Certificates and documents .000**																							
Color Sample							A4	H1	B3	B5	C1	A5	A6	B1	C6	C9	D3						
Number	A1	A2	E5	D5	I1	I5	G9		C5	G5	H5	E9	F1	F3	F5	I2	I6						
Percentage	23.8%	11.9%	7.2%	6.0%	4.8%	4.8%	3.6%		2.4%			1.2%											

Clothing and accessories .000**																							
Color Sample								B5	C5	D1	A3	A4	A5	B3	B8	C1	C6	D2	D6				
Number	A1	I5	A2	D5	E5	G5	I1	H7	I3		D9	E7	F1	F5	F7	H3	H8	I6					
Percentage	19.2%	14.4%	9.6%	7.2%	6.0%	4.8%	4.8%	2.4%			1.2%												

Personal belongings .000**																							
Color Sample						D6	E5	A1	A2	B9	C8	E1	E3	A3	A5	B2	E8						
Number	A6	H7	B3	C7	D1	B5	C4	F5	F9	H2	H3	I1	I5	F7	G5	G7	H9						
Percentage	16.8%	12.0%	7.2%	4.8%	4.8%	3.6%		2.4%						1.2%									

Keys .000**																							
Color Sample							C1	E5	I5	A4	A6	B5	F3	B7	C3	C9	D6	D9	E1	E7			
Number	A1	D5	C5	F1	B3	A2	I8	G6		F4	F7	H7		G1	G4	G6	G9	H1	I3				
Percentage	13.2%	9.6%	8.4%	6.0%	6.0%	4.8%	3.6%			2.4%				1.2%									

IT products .017																							
Color Sample							A2	C5	C6	A4	B8	B9	D1	D2	A5	A6	B1	B3	B5	B9			
Number	A1	D5	F5	G5	H7	H1	F6	I1	I5	G1	H5	I6	I9		E1	E5	E7	E9	G3				
Percentage	12.0%	9.5%	6.0%	4.8%	4.8%	4.8%	3.6%			2.4%					1.2%								



3.3 General discussions

This study used questionnaire survey and cross comparison of associated and not associated colors to investigate the association between categories of the commodities and colors. The survey result showed that the color sample B3 occupied a certain proportion of selections in many categories, including the following: 16.3% in certificates and documents, 11.3% in clothing and accessories, 8.8% in personal belongings, 18.8% in household appliances, and 16.3% in medical products. It can be concluded that bright colors such as B3 can better catch the attention of the elderly group.

Previous studies have showed that categorization of memorized items according to different characteristics could not only reduce the burden of memorization (Lee, 2008), but also improve the visual impact of an object's original color (Hung and Cheng, 2012). The colors associated with various categories of the commodities were determined through a category of the commodities and color matching experiment. The elderly group showed preferences for bright, vivid colors for most categories, such as the E3 color associated with clothing and accessories, the E7 color associated with IT products, the B3 color associated with household appliances and the A6 color associated with medical products. Only the A1 color was associated with household hardware, while the C5, A1and I5 colors associated with personal belongings were darker colors. In the elderly group, the visual sensory function gradually deteriorates with increasing age. Their ability to distinguish color also degenerates (Hawthorn, 2000). Therefore, bright and vivid colors, which were easier to distinguish even with degenerated vision, could enhance memorization and association; dark colors including black, even in different hues, were

more difficult for degenerated vision to distinguish and hence were less helpful to improve memorization and association.

Cross comparison result showed that the associated colors and not associated colors of most categories were at extreme ends of a spectrum. Repeated selection of associated and not associated colors was observed in only a few categories. Example: A1 occupied 24% of the selections for not associated color but only 2.5% for associated color to the certificates and documents category; B5 occupied 10.8% of the selections for not associated color but only 1.3% for associated color to the household appliances category. The disparity did not affect the corresponding colors for these categories. In the investigation of colors associated with categories of the commodities, while all the categories were statistically significant, some of the corresponding associated colors were not clear enough for some categories, such as C5, A1 and I5, which each accounted for 11.5% of selections for the personal belongings category; for the certificates and documents category, C3 accounted for 18.8% and B3 accounted for 16.3%; for the stationaries category, C3 accounted for 12.5%, C5 for 10% and H5 for 10%. The difference in the proportions was small. In the investigation of colors not associated with categories of the commodities and storage spaces, only IT products and kitchenware categories did not reach statistical significance. The proportions of selections accounted by not associated color to each category were substantially different from others.

4. Conclusions

This study conducted questionnaire surveys to investigate the colors associated with different categories of the commodities. The survey results showed that as the visual sensory functions of the elderly group deteriorated with increasing age, they could better distinguish bright, vivid colors but not darker colors. The study further revealed the corresponding colors for most categories of the commodities. In the future, repeated training of household goods category associations with colors for storage spaces could help turn the color associations for various categories into a cognitive system for the elderly group. This would allow for further investigation into whether color is beneficial in the memorization of item locations.

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