

[Original article]

The impact of AAC layout system on accuracy and preference of noun symbol selection in children and young adults

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ABSTRACT

Background and Objectives: The purpose of the present study was to investigate the performance of Korean children and young adults on Augmentative and Alternative Communication (AAC) with different layout systems (function-based layout vs. place-based layout). **Method:** Ten typically developing Korean children (M = 58 months, SD = 6.60) and ten young adults who speak Korean (M = 23.9 years, SD = 2.13) were asked to navigate vocabulary items in accuracy testing tasks and a preference testing task. **Results:** Children scored significantly lower on both accuracy tests ($F(1,18) = 27.51, p < .05$) than young adults. However, there was neither layout effect nor interaction effect. The children group preferred place-based layout ($F(1,18) = 5.57, p < .05$) while the young adults group preferred function-based layout ($F(1,18) = 4.80, p < .05$). Correlation analyses showed that in the young adults group, the preference of the function-based layout system was significantly related to the accuracy in the function-based layout condition ($r = .664, p < .05$). In the children group, the navigation accuracy in the function-based layout condition was negatively correlated with that in the place-based condition ($r = -.662, p < .05$). **Conclusion:** These results demonstrated that when considering the condition of AAC systems, clinicians must determine the appropriate layout for age, as well as the organization of the symbols on the display.

Key Words: augmentative and alternative communication (AAC), layout system, dynamic display, preference, children, adults

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INTRODUCTION

The current augmentative and alternative communication (AAC) technologies are largely based on conceptual models of adults who are not disabled (Light, 1993; Light & Drager, 2002; Light & Lindsay, 1991; Wallace, Hux, & Beukelman, 2010). As a result, there are cognitive demands placed on young children as well as children with complex communication needs.

Light (1992) proposed that there are at least four different approaches to organizing vocabulary: taxonomic (hierarchical categories), schematic (event schema), alphabetic, and idiosyncratic. Research with typically developing children suggests that younger children tend to use a schematic (i.e., event-based) organization; as children enter school, they learn to use categorical (i.e., function-based) organization (Bauer & Mandler, 1989; Krackow & Gordon, 1998; Lucariello, Kyratzis, & Nelson, 1992). For example, Fallon, Light, and Achenbach (2003) reported how typically developing children (ages 4 and 5) organized line drawings representing a variety of language concepts. The children were most likely to use schematic grouping (80%); less than 5 % reflected categorical grouping.

In others, however, 4- and 5-year-old typically developing children demonstrated similar, though both moderate, accuracy in both schematic and categorical organization conditions (Light, Drager, McCarthy, Mellott, Millar, Parrish, Parsons, Rhoads, Ward, & Welliver, 2004). They suggested that 4- and 5-year-old children may be able to learn either schematic (i.e., event-based) or categorical (i.e., function-based) organizations with instruction. They also mentioned that the theoretical advantage for schematic organizations were not observed because the schematic organizations in their studies may not have reflected the children's personal event schema. In previous studies, children were randomly assigned to each of the language organization conditions. Play contexts were developed to elicit each of the target vocabulary items; the rates of system use in free play, however,

were low.

Furthermore, it is important to explore whether previous findings will be held constant in a Korean language context. Although there were several studies on AAC vocabulary (Kim, Park, & Min, 2003; Lee, Kim, & Park, 2005; Park & Kim, 1996), few studies have investigated the impact of AAC layout systems. Lee, Lee, Kim, & Yeon (2015) investigated the performance of Korean children with and without intellectual disabilities (ID) on AAC with different layout systems. The results showed that the older children ($M = 5;3$) performed significantly better than the younger children ($M = 3;5$). This developmental effect is consistent with previous research. In addition, the older children showed no difference between two layout conditions while younger children were significantly better on place-based layout condition. The results implied that children learn to use categorical organization as they get older (Bauer & Mandler, 1989; Krackow & Gordon, 1998; Lucariello, Kyratzis, & Nelson, 1992). However, it is important to note that, in order to confirm the developmental effect in navigating vocabulary items, older group should be included in the data for analysis.

Thus, the current study examined (a) how accurate are typically developing 4- and 5-year-old Korean children and young adults who were in their 20s navigating to vocabulary prestored in AAC technologies using a place-based and a function-based layout systems, and (b) which language organization (place-related vs. function-based) would be preferred in the group. (c) We also investigated the relationship between navigation accuracy in each condition and the preference scores. We used place-based layout condition instead of event-based layout condition in order to minimize the effect of the personal event schema of young children.

METHOD

Participants

Ten typically developing Korean children (5 boys and 5 girls) and ten native Korean-speaking young adults (5 male and 5 female) participated in the study.

The age of the children ranged from 4;4 to 5;9 years ($M = 58$ months, $SD = 6.6$). Parental consent was obtained for each child. Parents were also given a questionnaire to fill out to check that the children had no history of neurological disorders, the children's auditory and visual acuity were normal, and the children had normal language development. All children scored within normal limits on the receptive vocabulary sub-test of the Korean Receptive and Expressive Vocabulary Test (REVT, Kim, Hong, Kim, Jang, & Lee, 2009a; Kim, Lee, Hong, Kim, & Jang, 2009b; Hong, Kim, & Kim, 2009).

Ten young adults ($M = 23.9$ years, $SD = 2.13$) were all in their 20s (range: 20~26 years). They were undergraduate or graduate students, so their language skills and cognitive abilities were considered as in normal range.

Participants were asked to navigate vocabulary items. They participated in two accuracy testing sessions and a preference testing session.

Materials

The materials and procedures used in the study was identical to those in Lee et al. (2015). The 27 items (18 items for accuracy test and 9 items for preference test) were selected from lists of words frequently used by young children (Kim, 2003; Pae, & Kwak, 2011). All vocabulary items were concrete nouns. The vocabulary was organized and presented according to the two different layout systems: function-based and place-based layout.

Accuracy tests

For the accuracy tests, 18 target vocabulary items were tested: 9 for function-based layout and 9 for place-based layout condition (Table 1). For each condition of accuracy test, the target vocabulary items were organized on three different vocabulary pages in a dynamic display system. The vocabulary layout was based on their function, with each page represented functional categories: specifically, home appliances/electronics (e.g., refrigerator), clothes (e.g., socks), and furniture (e.g., table); or on their place, with each page represented place where each item might be found: specifically, bathroom (e.g., towel), kitchen (e.g., microwave), and room (e.g., bed). Each vocabulary item appeared only once. In addition to the three vocabulary pages in each condition, there was also a main index page that include three symbols (Figure 1).

Table 1. Vocabulary for accuracy tests

		Place-related		
		Bathroom	Kitchen	Room
Function-based	Clothes	Gown Towel	Dishcloth Apron	Socks Pajamas
	Furniture	Toilet Bathtub	Table Sink	Bed Desk
	Home appliances	Hair drier Razor	Refrigerator Microwave	Lamp Radio

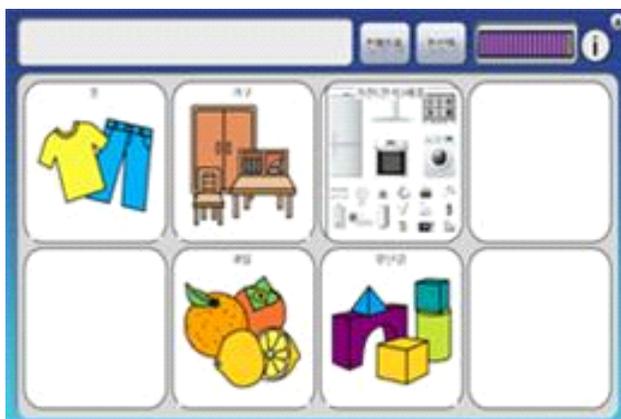


Figure 1. Main index page for accuracy test in function-based organization

Preference test

For the preference test, nine target vocabulary items were organized on six different vocabulary pages in a dynamic display system (⟨Table 2⟩). Each vocabulary item appeared twice (one for function-based and the other for place-related condition). In addition to the six vocabulary pages, there was also a main index page that include six symbols (⟨Figure 2⟩).

Table 2. Vocabulary for preference test

		Place-related		
		Kindergarten	Hospital	Beach
Function-based	People	Teacher	Doctor	Fisher
	Transportation	School bus	Ambulance	Ship
	Food	Snack	Porridge	Fish

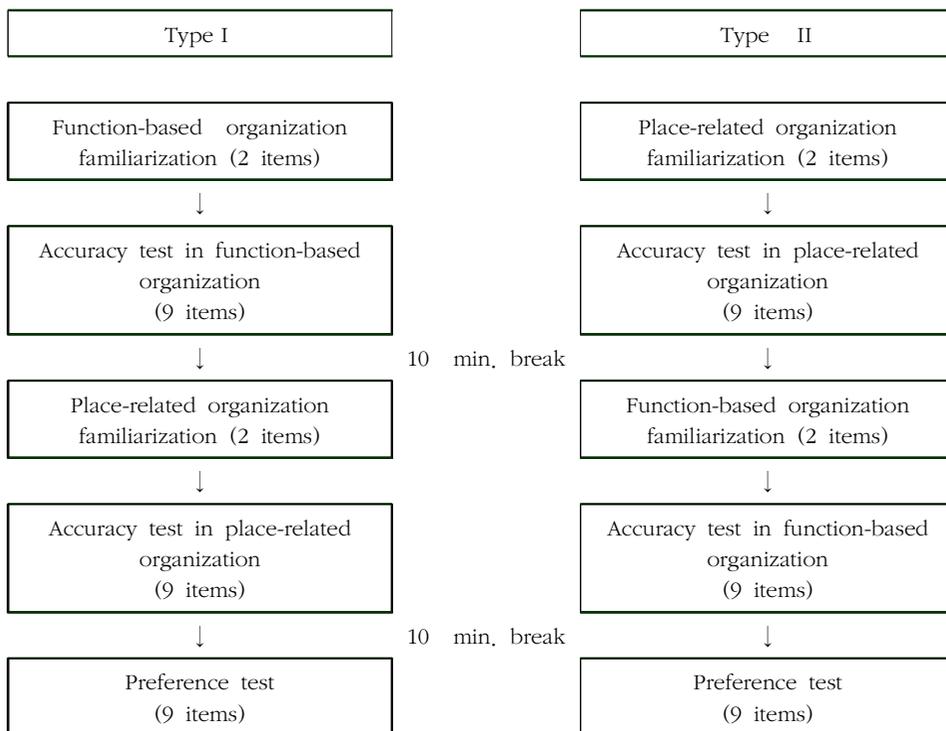


Figure 2. Main index page for preference test

Procedures

The outline of the experiment is illustrated in Table 3 (Lee et al., 2015). For the experiment, two accuracy tests and a preference test were administered. The two accuracy tests (place-based layout condition vs. function-based layout condition) were presented in randomly determined order for each child. That is, for the half of the children, the function-based layout system was presented first, while for the other half of the children, the place-based layout system was presented first. After the two accuracy tests, preference test was administered. For each test, participants were asked to locate the target item the examiner said. The MyTalkie Lite™ high-technology dynamic AAC device with a touch screen, was used for this study. All tests were conducted individually with the children in a quiet area within their preschools or homes.

Table 3. Procedures



Data Analysis

The percentages of correct responses for the participants in two accuracy tests (out of 9 potential items for the function-based layout and out of 9 potential items for the place-based layout systems) and the percentages of selecting function-based layout instead of place-based layout in preference test (out of 9 potential items) were calculated. A mixed 2 * 2 analysis of variance (ANOVA) were conducted to test the main effects and interaction effects of the following factors on the participants' performance: (a) group (children vs. adults) and (b) layout system (function-based vs. place-based). In addition, the correlation investigated the relationship between navigation accuracy in each condition and the preference scores.

RESULTS

Accuracy Performance

First, a mixed 2 * 2 ANOVA were conducted to test the group (children vs. adults) and layout system (function-based vs. place-based) effects on the participants' performance. Children scored lower than young adults on both navigation accuracy tests ($F_{(1,18)} = 27.51$, $p < .001$). There was neither layout effect nor interaction effect.

Table 3. Descriptive statistics of accuracy test performance

		Children (N=10)	Adults (N=10)
Accuracy test performance	Function-based layout	82.22% (9.37)	96.67% (7.50)
	Place-based layout	90.00% (9.73)	95.56% (7.77)

Note. Values are presented as mean (SD).

Preference Performance

Second, one-way ANOVA were conducted to test the group effect on the participants' performance. The children group preferred place-based layout ($F_{(1,18)} = 5.57$, $p < .05$); while the young adults group preferred function-based layout ($F_{(1,18)} = 4.80$, $p < .05$) when both conditions available in a single layout.

Table 4. Descriptive statistics of preference test performance

		Children (N=10)	Adults (N=10)
Preference test performance	Function-based layout	45.56% (13.30)	58.89% (13.91)
	Place-based layout	54.44% (13.30)	40.00% (14.05)

Note. Values are presented as mean (SD).

Correlation between Accuracy and Preference

Finally, we investigated the relationship between navigation accuracy in each condition and the preference scores. In young adults group, the preference to function-based layout system was significantly related to the accuracy in function-based layout condition ($r = .664$, $p < .05$) but not to that in place-based layout condition.

In children group, however, the preference to function-based layout systems was not related to the accuracy in neither conditions. However, accuracy in function-based layout condition was negatively correlated with the accuracy in place-based layout condition ($r = -.662$, $p < .05$).

Table 5. Correlation between Accuracy and Preference

	Children		Adults	
	Accuracy in function-based layout	Preference to function-based layout	Accuracy in function-based layout	Preference to function-based layout
Accuracy in place-based layout	-.662*			
Accuracy in function-based layout				
Preference to function-based layout			.664*	

* $p < .05$

DISCUSSION

In the present study, the performance of 4- and 5-year-old children and young adults on AAC with different layout systems (function-based layout vs. place-based layout) was investigated. First, children scored lower than young adults on both navigation accuracy tests. Second, the children group preferred place-based layout while the young adults group preferred function-based layout when both conditions available in a single layout. Finally, in young adults group, the preference to function-based layout system was significantly related to the accuracy in function-based layout condition but not to that in place-based layout condition. In children, however, the preference to function-based layout systems was not related to the accuracy in neither conditions.

Given that the literature on young children's sematic organization (Bauer & Mandler, 1989; Fallon, Light, & Achenbach, 2003; Krackow & Gordon, 1998; Lucariello, Kyratzis, & Nelson, 1992), it is interesting to note that the differences between the two language layout systems were not statistically significant. The study results implied that this theoretical advantage for schematic organizations begin to go away by the age of 5, even before they enter school (Fallon et al., 2003; Lee et al., 2015).

However, the study results showed that the children still preferred place-based layout system when both conditions available in a single layout. In addition, their performance on function-based layout condition was negatively related with those on place-based layout condition. The results of the study suggests that 4- and 5-year-old Korean children might struggle to organize their language concepts. This struggle would be settled down as they enter school and learn categorical organizations through formal school instruction (Lucariello, 1998; Nelson, 1996). The results also showed that when considering the component of AAC systems, clinicians must determine the appropriate layout as well as the organization of the symbols on the

display (Damico, Müller, & Ball, 2010).

Although the study provide important information to help in better understanding the language organizations of AAC systems for young children, the study involved only small number of children and the results may not generalize to children with developmental disabilities. Further validation of the results with children with disabilities who require AAC is required. Moreover, although the impact of AAC layout system on accuracy and preference was the focus of the investigation, future research is needed to explore the relationship between accuracy and speed of symbol location (Wilkinson, Carlin, & Jagaroo, 2006).

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국문초록

보완대체의사소통의 어휘 배열 체계가 아동과 성인의 명사 상징 선택의 정확도 및 선호도에 미치는 영향

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배경 및 목적: 본 연구에서는 최근 보급이 증가하고 있는 태블릿 PC의 역동적 디스플레이를 사용하여 AAC 어휘 배열 체계(기능적 배열 및 장소적 배열)가 아동의 어휘 선택에 미치는 영향을 성인과 비교하고자 하였다. **방법:** 열 명의 아동과 열 명의 성인을 대상으로, 각각의 어휘 배열 체계에서 정확도 평가를 실시한 후, 두 가지 어휘 배열 체계가 동시에 제시된 조건에서 선호도 평가를 실시하였다. **결과:** 아동 집단은 두 가지 조건에서 모두 성인 집단보다 낮은 수행을 보였다($F_{(1,18)} = 27.5, p < .05$). 어휘 배열 방법과 상호작용 효과 모두 유의하지 않았다. 아동은 장소적 배열을 선호한 반면($F_{(1,18)} = 5.57, p < .05$), 성인은 기능적 배열을 선호하였다($F_{(1,18)} = 4.80, p < .05$). **논의 및 결론:** 연구 결과, 아동은 성인과는 달리 기능적 배열보다 장소적 배열을 선호하는 모습을 보였으며, 이는 임상에서 AAC 선택 시 대상자에게 적절한 어휘 배열 체계를 고려해야 함을 시사하고 있다.

핵심어: 보완대체의사소통(AAC), 어휘 배열, 역동적 디스플레이, 선호도, 아동, 성인

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