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공학석사 학위논문

Handedness-Associated Stereotypes of Windows Arrangement during Computer Text Copying Task

- 컴퓨터를 이용한 텍스트 옮겨 적기 작업 시 창 배치에 대한 손잡이(handedness) 관련 스테레오타입 -

2016 년 2 월

서울대학교 대학원

산업공학과 인간공학 전공

조 창 래

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지도교수 박 우 진

이 논문을 공학석사 학위논문으로 제출함
2016 년 2 월

서울대학교 대학원
산업공학과 인간공학 전공
조 창 래

조창래의 석사학위논문을 인준함
2016 년 2 월

위 원 장 윤 명 환 (인)
부위원장 박 우 진 (인)
위 원 홍 유 석 (인)

ABSTRACT

Right-handers and left-handers usually conduct manual tasks in different arrangement of work elements due to physical constraints caused by handedness. The accumulation of such physical experiences may develop a kind of stereotype regarding the arrangement of work elements, which may have influence on performing a task in an environment free of physical constraints. The stereotype is defined as "handedness-associated stereotype" in this research. The objectives of the current study are (1) to explore the presence of the handedness-associated stereotype, (2) to investigate whether the stereotype, if it exists, is developed from physical experiences, and (3) to demonstrate the effect of the stereotype on preference and task performance by empirical test under no physical constraint. To this end, two experiments were conducted in which right-handers and left-handers copied a text from one to another through handwriting and keyboarding. In Experiment 1, participants freely arranged the two sheets (or windows) during both tasks, and their window arrangement methods were collected for each task. In Experiment 2, two windows' arrangement conditions were given, and preference and task performance were measured for each condition. As a result, the two handedness groups arranged the windows in opposite methods, and their individual arrangement methods for the handwriting tasks were in accordance with those for the keyboarding task. Also, significant difference between the right-handers

and left-handers was found in experiment regarding preference, but not in task performance. These results suggest that right-handers and left-handers have different stereotypes regarding the arrangement of work elements, and therefore handedness should be considered in order to design user-interface with higher preference. Lastly, the results suggest that these stereotypes may be derived from experiences regarding handwriting.

Keywords: population stereotype; compatibility; handedness; physical experience

Student Number: 2014-20641

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1. INTRODUCTION

In ergonomics and human factors engineering, the concepts of population stereotype and compatibility have been extensively studied. A population stereotype is defined as the expectation for the relationship between stimulus-stimulus, response-response or stimulus-response that most of the population possess. Compatibility refers to the degree of which the relationship between stimulus and response correspond to the user's stereotype (Fitts and Seeger 1953). Human-artifact interfaces must be designed to maximize compatibility - interfaces compatible with the user's stereotype can help the user learn faster, respond faster and reduce errors (Fitts and Seeger 1953, Fitts and Deininger 1954, Sanders and McCormick 1987, Proctor and Reeve 1989, Chua et al. 2001, Lee and Chan 2007, Chan and Chan 2011); also, artifacts with high compatibility may improve the user's emotional experience. People are known to prefer compatible relationship over incompatible relationship (Bauer et al. 1982, Sanders and McCormick 1987).

Due to the importance of compatibility in the design of interfaces, previous research efforts focused on identifying and understanding various types of compatibility. Currently, four different types of compatibility are widely discussed in the literature (Sanders and McCormick 1987); conceptual, movement, spatial, and modality. Conceptual compatibility refers to the degree

of which codes and symbols in system correspond to the conceptual meaning people have. Movement compatibility deals with the relationship between the movement direction of controls and the response direction of displays. Spatial compatibility refers to the physical similarity regarding the arrangement of display-control design. Modality compatibility relates to the fact that people feel compatible with the certain modality combination of stimulus and response.

In addition, discovering new stereotypes is as important as identifying compatibility in that new stereotypes can lead to new compatible relationships that correspond to them. This can help further improve the design of human-artifact interfaces, and, therefore, represents an important goal of ergonomics/HF research (Wu 1996, Tlauka 2004, Karwowski 2005). The current study is concerned with possible new stereotypes associated with human handedness.

Handedness refers to the differences in capability between the two hands. During a manual work task, handedness appears to act as physical constraints and significantly affect the spatial arrangement of work elements – the dominant hand is assigned to the more difficult subtask and the non-dominant, the relatively easier subtask; and, then, the work elements are spatially arranged according to the hand-subtask assignments. For instance, when right-handers cut a piece of paper with scissors, they usually hold the paper in their left hand in order to use scissors with their dominant right hand; left-handers typically

use the opposite arrangement. Also, when copying down a text in a sheet onto a separate blank sheet with a pen, right-handers tend to place the text sheet on their left side and the blank sheet on their right side, whereas left-handed people prefer the opposite arrangement. This is because people typically use the pen with their dominant hand and placing the blank sheet on the dominant hand side allows better upper body posture and alleviates the problem of an upper limb occluding the text sheet (Malik and Laszlo 2004, Brandl et al. 2009, Kang and Shin 2014) than the other arrangement. In this manner, different handedness types can give rise to different handedness-specific arrangements of work elements.

In daily life and work activities, an individual would experience particular arrangements of work elements determined by his/her handedness repeatedly over time. Such repeated experience may give rise to the formation of certain "mental" expectations, that is, stereotypes about the spatial relationships between common work elements. Consequently, right-handers and left-handers may have different stereotypes regarding the arrangement of work elements as a result of the differences in their life experience.

Existing research studies indeed lend support to the possibility of handedness-associated stereotypes formed by repeated experience. Wickens (1992) described population stereotype as experience-related mapping, which was supported with an example that showed the different stereotypes of light

switch movement between the North American and the European populations. Wong and Lyman (1988) also examined empirically the different stereotypes of control-display arrangements between the Americans and the Japanese. These studies mentioned that such differences in stereotype cannot be interpreted by the differences in the psychological attributes, but rather by a function of experience from different cultures. Relatedly, Noordzij (2006) empirically showed that visual experience influences the formation of spatial mental model. Also, according to the body-specificity hypothesis suggested by Casasanto (2009a), mental representation of space could differ depending on the way that people interact with physical world. For example, right-handers and left-handers, who behave in systematically different ways, have different representations of the physical world with positive and negative emotional valence such as "goodness" and "intelligence" (Casasanto 2009b, Casasanto 2012).

If handedness-associated "mental" stereotypes indeed exist, they may reveal themselves even in the situations where the differences in capability between the two hands are no longer relevant, and, hence, there is no apparent "physical" needs for a particular handedness-specific arrangement of work elements. For example, when people copy a text from one computer window onto another within a monitor screen using a keyboard, they are free from physical constraints of handedness – a keyboard is designed for use with both hands and

excludes possibility of occlusion of the screen by the upper limbs in any situations. In such environment, the choice between the two arrangements (placing the blank window on the dominant hand side versus the non-dominant hand side on the screen) should not make any differences if considered purely from the physical point of view. Nevertheless, if people indeed have the handedness-associated "mental" stereotypes regarding spatial arrangement of work elements, their existence may be manifested even in such keyboard task, in the form of a bias towards an arrangement compatible with the individual's stereotype.

Identifying handedness-associated stereotypes concerning spatial arrangement of work elements appears to be an important research topic as it can lead to better accommodation of users of different handedness in the design of a wide range of interfaces; it also contributes to the current body of knowledge on stereotypes and their formation. Despite the importance, however, few research studies have examined such possibility. As an effort towards addressing the research gap, two experiments were conducted in which right-handers and left-handers performed text copying through handwriting and keyboarding. In Experiment 1, the participants freely arranged a text and a blank sheet on a physical desktop for a hand transcription task. They also performed a similar windows arrangement task during a computer keyboard transcription task. The participants' work elements arrangement patterns were

examined to test the existence of handedness-associated arrangement patterns in each task condition and also the agreement in the results between the two task conditions. In Experiment 2 where only the keyboarding task was conducted, two windows arrangement types (the blank window on the dominant hand side and the text window on the non-dominant hand side versus the opposite) were given, and preference levels and task performance of the study participants were measured for each arrangement type. Interaction between handedness and windows arrangement type was examined for each dependent measure.

2. EXPERIMENT 1

2.1. Participants

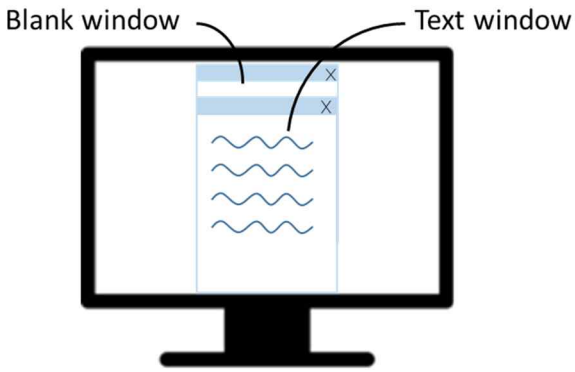
Forty participants (20 right-handers and 20 left-handers by self-report) were recruited from the website of Seoul National University for this experiment. Each participant's handedness was assessed through the modified 7-item Edinburgh Handedness Inventory (Oldfield 1971, Milenkovic and Dragovic 2013). As a result, five participants of self-reported left-handers with laterality quotient (LQ) below -60 were excluded from the experiment. Finally, 20 right-handers (mean LQ = 95.5) and 15 left-handers (mean LQ = -78.3) participated in this experiment and their average age was 22.7.

2.2. Data collection

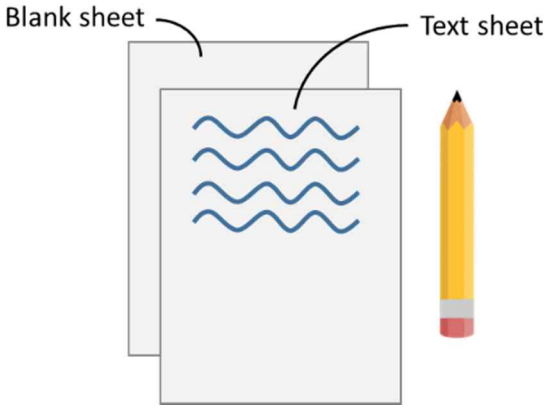
Data collection was conducted in a laboratory with computer work environment. The workstation consisted of a 27-inch monitor, a desktop PC running Microsoft® Windows 7, an external keyboard and a mouse on a table. A text window and a blank window on the screen were provided using Microsoft® Word.

Prior to the experiment, each participant sat on a fixed chair placed in front of the monitor and adjusted the posture to match the center of their body with the center of the screen. Two overlapped windows, a text window and a blank window, were given in the center of the screen (Figure 1 (a)), and the participants were instructed to copy the text onto the blank window using a keyboard (namely, the keyboarding task). No instruction about the window arrangement was given to the participants, allowing them to naturally arrange the windows during the task. After finishing the keyboarding task, the participants rested for a while to avoid the previous task affecting the following task. During the break time, the keyboard and the mouse were removed from the table in order to allow plenty of space for the next task. Then, the participants received two overlapping sheets; a text sheet and a blank sheet (Figure 1 (b)), and they were asked to manually copy down the text onto the blank sheet (namely, the handwriting task). At the end of the experiment,

participants were briefly interviewed whether the keyboarding task had influenced the handwriting task or whether they had recognized the intention of the experiment while performing the tasks. All participants replied that they did not realize the intention of the experiment and the association of the two tasks. The texts used in the two tasks were composed of passages from George Orwell's novel "Animal Farm". The order of which the sheets or the windows were overlapped was counterbalanced across the participants for each task.



(a)



(b)

Figure 1. Initial arrangements of the two copying tasks: (a) keyboarding task, (b) handwriting task.

2.3. Data analysis

Arrangement methods for handwriting and keyboarding tasks were collected from the experiment. The arrangement methods were categorized according to similarity of the two sheets' (or windows') relative positions. Chi-square test was used to compare the arrangement methods of right handers and left-handers in each task. Then cross-tabulation analysis was used to examine whether a participant's arrangement method for the handwriting task was in accordance with that for the keyboarding task regardless of handedness. In addition, Goodman and Kruskal's lambda was used as a measure of association ranging from 0 to 1. The lambda is based on the proportional reduction in error when the arrangement method of handwriting task was used to predict that of keyboarding task (LA Goodman and WH Kruskal 1954). For all comparisons, a p-value of < 0.05 was considered statistically significant and statistical software packages (SPSS™) were used.

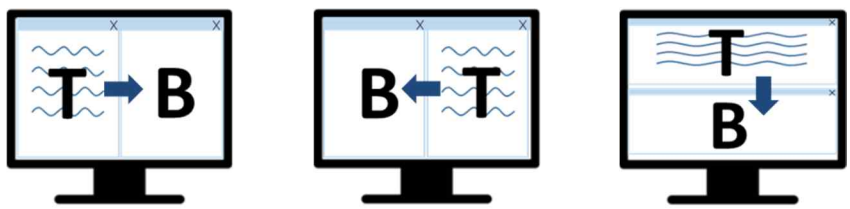
2.4. Results

The arrangements collected during both tasks can be categorized into the three window arrangement methods below (Figure 2).

(1) Left-Text-Right-Blank (LT-RB) method: text on the left and blank space (text and window) on the right.

(2) Left-Blank-Right-Text (LB-RT) method: blank space on the left and text on the right.

(3) Up-Text-Down-Blank (UT-DB) method: text on the top and blank space on the bottom.



(1) LT-RB **(2) LB-RT** **(3) UT-DB**

Figure 2. Three arrangement methods used by the participants in Experiment 1.

Figure 3 shows the proportions of the participants that selected each of the arrangement methods in conducting the handwriting task. The majority (66.7%) of the left-handers copied the text using the arrangement LB-RT, whereas the majority (65%) of the right-handers conducted the task with the arrangement LT-RB. Chi-square test found a statistically significant difference in arrangement method during the handwriting task between the right-handers and the left-handers ($\chi^2 = 20.81$, $p < 0.001$).

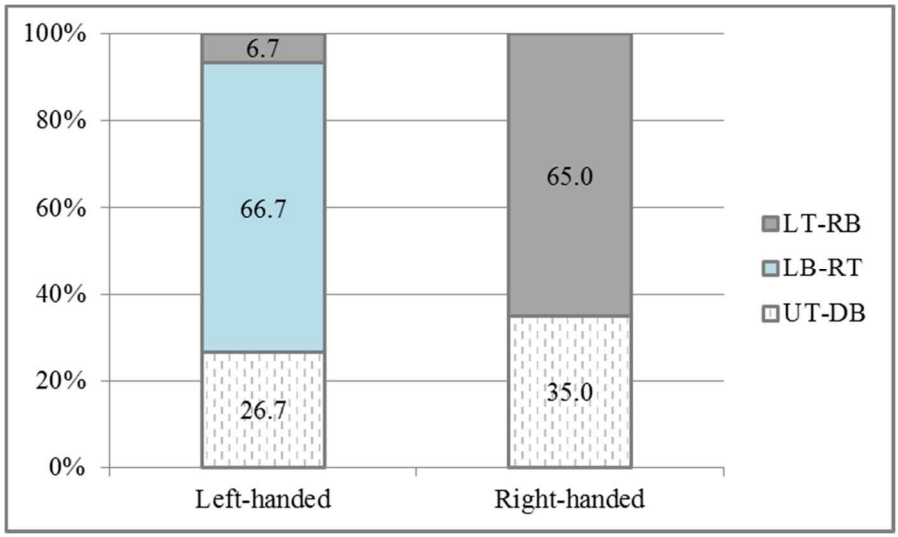


Figure 3. Proportions of the used arrangement methods during the handwriting task.

Figure 4 shows the proportions of the participants that used each of the arrangement methods in conducting the keyboarding task. The majority (66.7%) of the left-handers copied the text with the arrangement LB-RT, whereas the majority (65%) of the right-handers copied the text with the arrangement LT-RB. Chi-square test found a statistically significant difference in window arrangement method during the keyboarding task between the right-handed people and the left-handed people ($\chi^2 = 9.82$, $p = 0.007$).

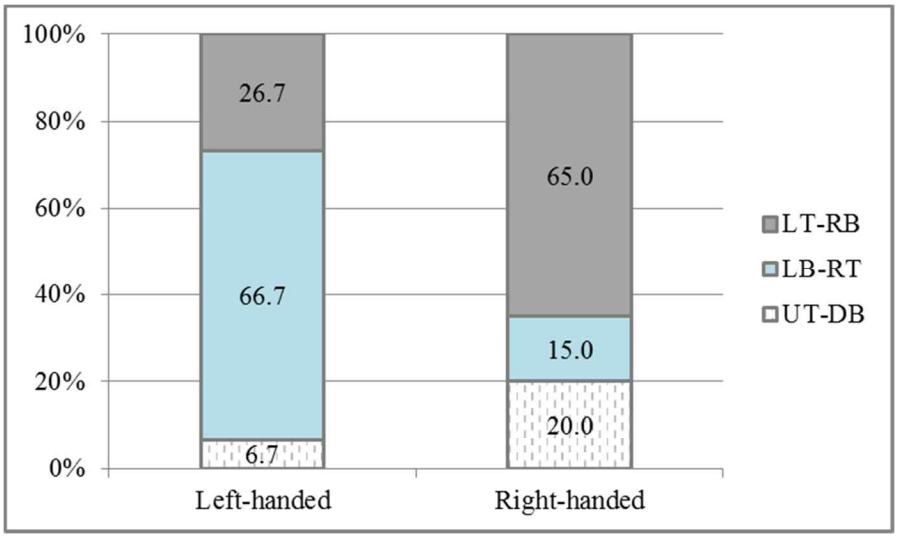


Figure 4. Proportions of the used arrangement methods during the keyboarding task.

Table 1 shows a cross-tabulation table that explores the relationship between the two arrangement methods; one for the handwriting task and the other for the keyboarding task. The majority of the people who performed the handwriting task with the arrangements LT-RB (71.4%) and LB-RT (80%) also conducted the keyboarding task using the same arrangement respectively. Participants who carried out the handwriting task with the arrangement UT-DB used the arrangement LT-RB the most for the keyboarding task, but the result was not less apparent. Furthermore, a significant value of Goodman and Kruskal's lambda was found (p-value = 0.011). A lambda of 0.389 means that the arrangement during handwriting would help to reduce the error in predicting the arrangement during keyboarding task by 38.9%.

Table 1. Cross tabulation table between the used arrangement methods for the handwriting task and the keyboarding task

			Arrangement during keyboarding			
			LT-RB	LB-RT	UT-DB	Total
Arrangment during handwriting	LT-RB	# of people	10	2	2	14
		% within arrangement during keyboarding	71.4%	14.3%	14.3%	100.0%
	LB-RT	# of people	1	8	1	10
		% within arrangement during keyboarding	10.0%	80.0%	10.0%	100.0%
	UT-DB	# of people	6	3	2	11
		% within arrangement during keyboarding	54.5%	27.3%	18.2%	100.0%
Total		# of people	17	13	5	35
		% within arrangement during keyboarding	48.6%	37.1%	14.3%	100.0%

3. EXPERIMENT 2

3.1. Participants

In Experiment 2, 45 participants (27 right-handers, 27 left-handers by self-report) were recruited from the same community used for Experiment 1. Handedness was assessed through the modified 7-item Edinburgh Handedness Inventory, and seven participants of self-reported left-handers with laterality quotient (LQ) below -60 were excluded from the study. Finally, 27 right-handers (mean LQ = 94.8) and 20 left-handers (mean LQ = -87.0) participated in this experiment and their average age was 23.6.

3.2. Variables

Two independent variables were manipulated in a mixed design with participants' handedness as a between-group variable, and window arrangement condition as a within-subject variable. Handedness was considered with two levels, right-handed and left-handed, and window arrangement condition also consisted of two levels, the arrangement LT-RB and LB-RT (Figure 2).

Six dependent variables were measured in this experiment: four subjective rating scores and two task performance measures. Table 2 shows the dependent variables and their definitions. Four kinds of subjective ratings were performed by a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) for each of the two window arrangement conditions.

Table 2. Definitions of the dependent variables

Dependent variables		**Definition**
Subjective ratings (1~7 point scale)	Comfort	How comfortable the window arrangement was to conduct the copy task
	Naturalness	How natural the window arrangement was to conduct the copy task
	Familiarity	How familiar the window arrangement was to conduct the copy task
	Preference	How preferable the window arrangement was to conduct the copy task
Task performance	Task completion time (sec)	Amount of time spent completing the copying task
	Number of error	Number of omitted, additional, and incorrect key strikes during the task

3.3 Procedure

The experiment was conducted in the same environment as Experiment 1. Prior to data collection, participants sat on a fixed chair placed in front of the monitor and adjusted the posture to match the center of his or her body with the center of the monitor screen. Then, they were shown a paragraph of text and were asked to copy it onto a blank window with a given window arrangement condition (LT-RB or LB-RT) using the keyboard. In order to prevent the previous task affecting the following task, the participants had a 15-minute break in between the tasks. The participants adjusted the posture again before the beginning of the second task and copied text with the other arrangement condition. After finishing both tasks, they completed subjective ratings for the two arrangement conditions. During the both tasks, the entire computer screen was video recorded for measuring the task performance.

Two different paragraphs from George Orwell's novel "Animal Farm" were used within the tasks to avoid the learning effect. Both of them consisted of equivalent number of words. The order of the two paragraphs and the two arrangement conditions was counterbalanced across participants within each handedness group.

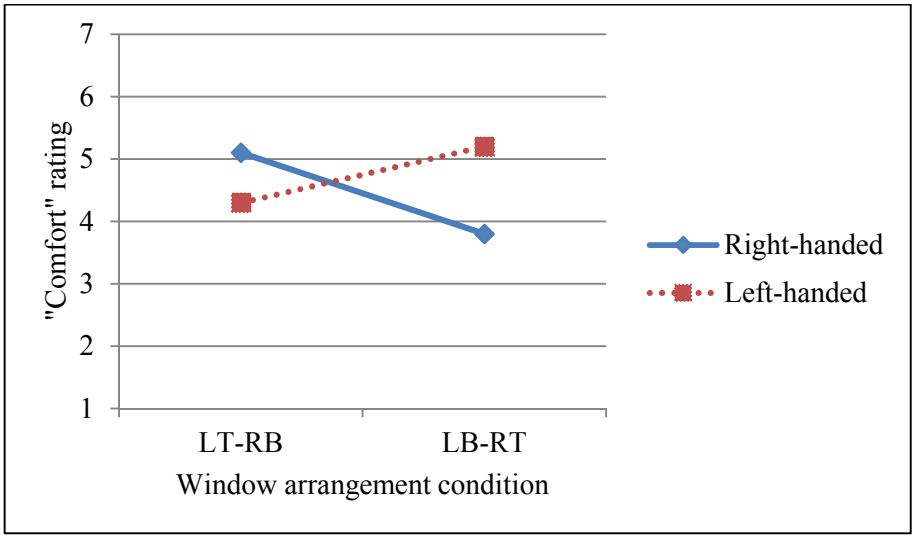
3.4. Data analysis

Subjective ratings for the two window arrangement conditions were collected through the experiment. The task completion time and the number of errors were also extracted from the captured video data. The task completion time was measured as the time interval between the first keystroke and the last keystroke. Errors were calculated on the basis of omitted, additional, and incorrect key strikes, and a series of errors occurring at once were considered as one error.

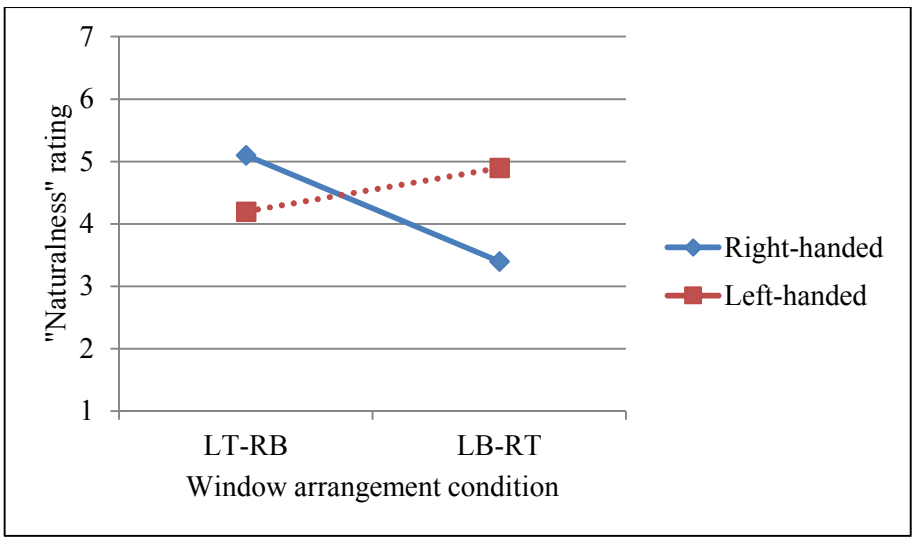
Effects of handedness on the subjective ratings and the task performance in each window arrangement condition were evaluated by two-way repeated measures ANOVA. Paired t-tests were carried out to compare the differences between the arrangement conditions within each handedness group. For all comparisons, a p-value of < 0.05 was considered statistically significant and statistical software packages (Microsoft Excel and SPSS™) were used.

3.5. Results

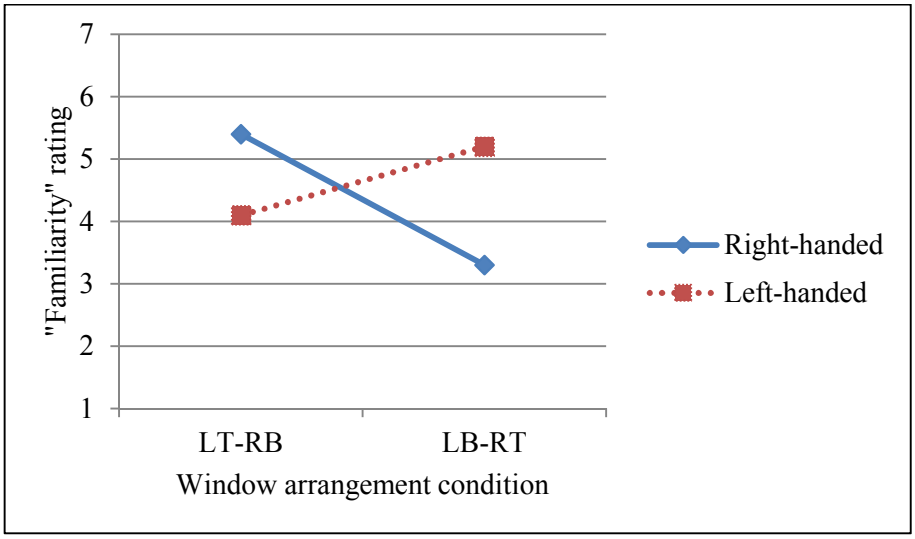
The repeated measures ANOVA found a significant interaction effect between handedness and window arrangement on every criteria of subjective ratings (handedness x arrangement interaction: p-value; comfort = 0.007, naturalness = 0.012, familiarity = 0.001, preference = 0.001; Figure 5). Participants mostly preferred to assign the blank window on their dominant side and the text window on their non-dominant side. The paired t-test showed that the subjective ratings of the right-handers were significantly greater for the arrangement LT-RB than LB-RT (p-value; comfort = 0.0145, naturalness = 0.0149, familiarity = 0.0032, preference = 0.0004), whereas no significant effect of window arrangement condition was found for the left-handers (p-value; comfort = 0.189 0, naturalness = 0.3195, familiarity = 0.1041, preference = 0.2011).



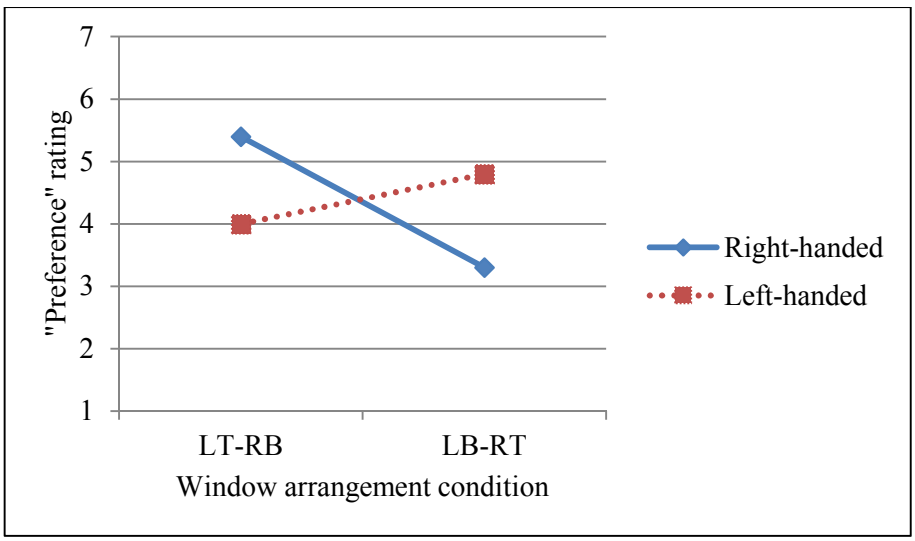
(a) “Comfort” ratings



(b) “Naturalness” rating



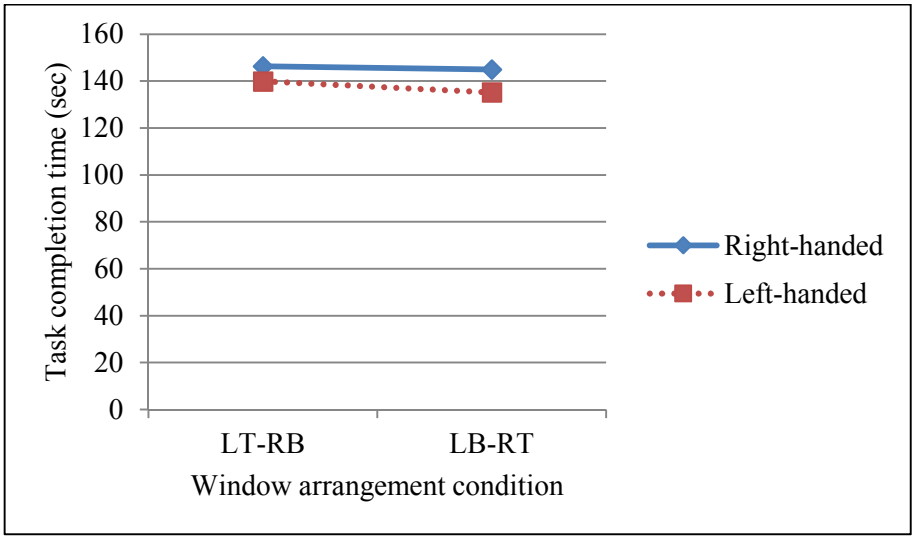
(c) “Familiarity” rating



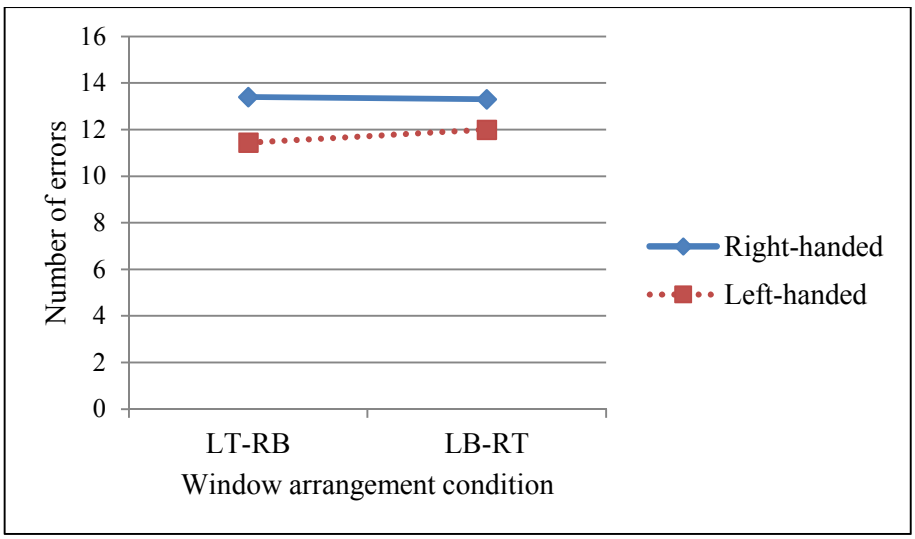
(d) “Preference” rating

Figure 5. Results of subjective ratings for each handedness group in the two window arrangement conditions LT-RB and LB-RT.

The repeated measures ANOVA showed that there was no significant handedness effect on task performance (task completion time, number of errors), and no interaction effect between handedness and window arrangement condition (Figure 6).



(a) Task completion time



(b) Number of errors

Figure 6. Results of task performance for each handedness group in the two window arrangement conditions LT-RB and LB-RT.

4. DISCUSSION

In Experiment 1, the window arrangement methods during handwriting and keyboarding task were found from 35 participants of different handedness. As a result, most of the right-handers selected LT-RB and most of the left-handers selected LB-RT during the both tasks. The fact that the two handedness groups selected the opposite arrangement methods, regardless of the physical constraints, suggests that psychological factors, rather than physical factors, affect the results. These psychological factors can be thought of as the handedness-associated stereotypes regarding the arrangements.

In addition, their individual arrangement methods for the handwriting task were in accordance with those for the keyboarding task. This association suggests that the stereotype may be deriving from experiences of handwriting. However, contrary to our expectation, participants who conducted the handwriting task with the arrangement UT-DB used the arrangement LT-RB the most during the keyboarding task. Unlike the handwriting task, only few participants selected UT-DB arrangement for the keyboarding task. This may be due to a wide shape of the monitor.

In Experiment 2, subjective ratings and task performance for the two window arrangement conditions, the arrangement LT-RB and LB-RT, were measured from 47 participants of different handedness. The results of the subjective

ratings showed that the two handedness groups preferred different window arrangement condition. It could be assumed that right-handers and left-handers had different stereotype regarding the window arrangement and preferred the arrangement according to their stereotype. The results of post-hoc test showed that the left-handed participants had weaker laterality than the right-handed participants. These results were consistent with those of previous research which measured laterality of preference and task performance (Peters, Michael, and Bruce Durding 1979, Borod, Joan C. et al. 1984, Peters, Michael, and Philip Servos. 1989, Hoffmann 1997a, Hoffmann 1997b, Peters 1990, Steenhuis, R. E. 1999). Different from the current study, these researches were conducted using manual task with physical constraints. Nevertheless, the similar tendency of laterality is applicable to interpret the results of this study. The previous researches suggest left-handers have more chance to practice with their non-dominant hand in a right-handed world. Furthermore, this study suggests left-handers have more cognitive experience associated with the non-dominant in a right-handed world.

Performing the keyboarding task with the arrangement condition which is different from their stereotype was also expected to cause cognitive confusion, and it was hypothesized to have a negative effect on task completion time and number of errors. However, no significant difference was found in task performance.

The reason for statistically significant difference being found only in subjective ratings is intriguing and we can propose an explanation that the copying task may be too easy. Once the participants perceive the given window arrangement, they only need to repeat the same cognitive process during the tasks. These simple cognitive process could cause a temporary confusion for the participants, but not enough to significantly affect the results of task performance.

This research makes several theoretical contributions. It is the first research to investigate the association of handedness and the arrangement of work elements in an environment free of physical constraints. Most studies of ergonomics demonstrating the associations of handedness and the arrangement of work elements were carried out with manual tasks (e.g., tapping buttons, hand writing), and explained that the associations resulted from physical constraints caused by handedness. On the other hand, no physical constraints existed in the keyboarding task of this study, therefore we explained the associations as a result of the handedness-associated stereotype.

There has been active research of psychology on the effects of handedness on spatial arrangement, yet their approaches do not coincide with the current study. The psychology studies focused on difference of emotional valence regarding space itself, whereas this study concentrated on preferred arrangement when performing certain tasks. For example, Casasanto's body-

specificity hypothesis is not appropriate to account for the results of the experiments, because it suggests difference of preference regarding the position of objects without any task. Rather, it is more proper to say that the results were caused by the effect of the handedness-associated stereotype. To our best knowledge, this is a new type of population stereotype regarding the arrangement which varies depending on their handedness.

Moreover, the research method of the current study could be applied to various contexts to explore the different stereotypes that may exist. For example, when using the "MS paint" right-handers and left-handers may prefer different position of the color palette. It is attributable to repetitive experiences of drawing in physical world. People generally hold a palette in their non-dominant hand, and therefore the two handedness groups may have different expectation of the palette position.

Results of this study can be widely applied to designing user-interface layout. The results suggest that handedness should be considered when designing user-interface of not only direct input devices such as touch interface, but also indirect input devices. Designing user-interface layout according to the user's handedness-associated stereotype would improve the compatibility of the product design, and allow users to favor and to be satisfied with the user-interface.

Though the current study implies the presence of the handedness-associated stereotype related to arrangement of work elements, further research is needed to validate the findings. For example, by comparing the effects of the stereotype between different age groups, the contention that the stereotype is derived from physical experience may be validated. Most children have few experiences of both handwriting and keyboarding, whereas the elderly are accustomed to handwriting with very little to no experience of keyboarding. Therefore, if the stereotype is indeed developed from the experience of manual task, the gap of handwriting experience between the two groups may have influence on the strength of their stereotype.

Furthermore, in order to generalize the findings, additional studies should be conducted considering a variety of tasks as those mentioned previously through the MS Paint example. Also, different indirect input devices, such as voice or gesture recognition systems, should be considered.

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APPENDIX A: Descriptive statistics of Experiment 2

Descriptive statistics of right-handed people obtained by Experiment 2 (N = 27)

Variables	Window arrangment condition	Mean	SD	Maximum	Minimum
Comfort	LT-RB	5.07	1.385	7	2
	LB-RT	3.81	1.145	6	2
Naturalness	LT-RB	5.15	1.791	7	2
	LB-RT	3.44	1.649	6	1
Familiarity	LT-RB	5.41	1.803	7	2
	LB-RT	3.33	1.468	6	1
Preference	LT-RB	5.41	1.366	7	3
	LB-RT	3.30	1.353	6	1
Completion time (s)	LT-RB	146.26	48.241	326	105
	LB-RT	144.89	44.998	295	96
Num of error	LT-RB	13.41	7.572	36	4
	LB-RT	13.30	8.566	43	3

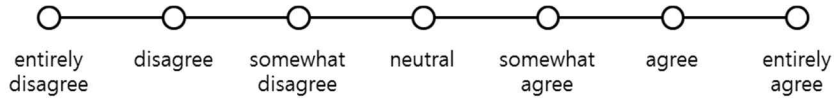
Descriptive statistics of left-handed people obtained by Experiment 2 (N = 20)

Variables	Window arrangment condition	Mean	SD	Maximum	Minimum
Comfort	LT-RB	4.25	1.552	7	2
	LB-RT	5.15	1.496	7	2
Naturalness	LT-RB	4.2	1.765	7	2
	LB-RT	4.9	1.483	7	2
Familiarity	LT-RB	4.05	1.638	7	2
	LB-RT	5.15	1.496	7	2
Preference	LT-RB	3.95	1.572	7	2
	LB-RT	4.8	1.508	7	2
Completion time (s)	LT-RB	139.95	33.222	219	91
	LB-RT	135.20	32.612	218	82
Num of error	LT-RB	11.45	5.680	23	3
	LB-RT	12.00	5.629	23	2

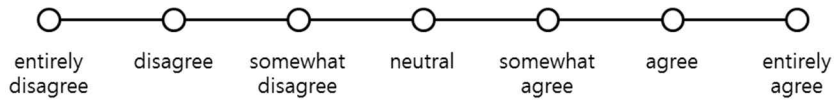
APPENDIX B: Subjective evaluation questionnaire

Name: Age: Sex:

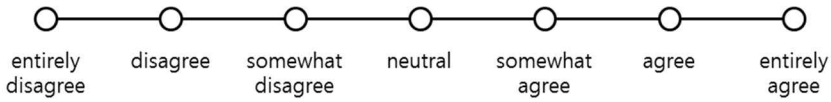
1-1) It was comfortable to conduct the copying task in the first window arrangement.



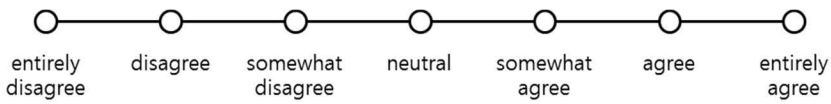
1-2) It was comfortable to conduct the copying task in the second window arrangement.



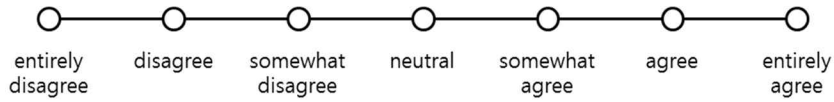
2-1) It felt natural to conduct the copying task in the first window arrangement.



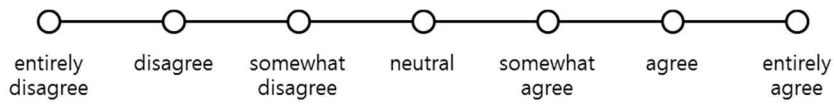
2-2) It felt natural to conduct the copying task in the second window arrangement.



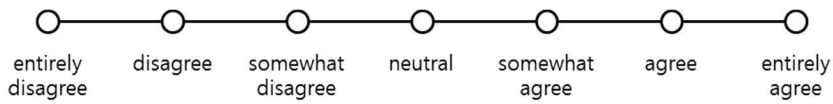
3-1) It was familiar to conduct the copying task with the first window arrangement.



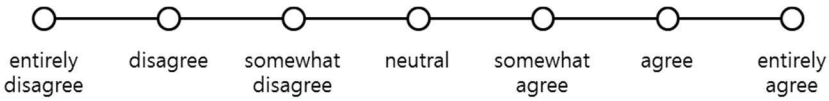
3-2) It was familiar to conduct the copying task with the second window arrangement.



4-1) I like working with the first window arrangement.



4-2) I like working with the second window arrangement.



- The end -

Thank you for participating in this experiment.

ABSTRACT

Handedness-Associated Stereotypes of Windows Arrangement during Computer Text Copying Task

Changrae Cho
Ergonomics, Industrial Engineering
The Graduate School
Seoul National University

Right-handers and left-handers usually conduct manual tasks in different arrangement of work elements due to physical constraints caused by handedness. The accumulation of such physical experiences may develop a kind of stereotype regarding the arrangement of work elements, which may have influence on performing a task in an environment free of physical constraints. The stereotype is defined as "handedness-associated stereotype" in this research. The objectives of the current study are (1) to explore the presence of the handedness-associated stereotype, (2) to investigate whether the stereotype, if it exists, is developed from physical experiences, and (3) to demonstrate the effect of the stereotype on preference and task performance by empirical test under no physical constraint. To this end, two experiments were

conducted in which right-handers and left-handers copied a text from one to another through handwriting and keyboarding. In Experiment 1, participants freely arranged the two sheets (or windows) during both tasks, and their window arrangement methods were collected for each task. In Experiment 2, two windows' arrangement conditions were given, and preference and task performance were measured for each condition. As a result, the two handedness groups arranged the windows in opposite methods, and their individual arrangement methods for the handwriting tasks were in accordance with those for the keyboarding task. Also, significant difference between the right-handers and left-handers was found in experiment regarding preference, but not in task performance. These results suggest that right-handers and left-handers have different stereotypes regarding the arrangement of work elements, and therefore handedness should be considered in order to design user-interface with higher preference. Lastly, the results suggest that these stereotypes may be derived from experiences regarding handwriting.

Keywords: population stereotype; compatibility; handedness; physical experience

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