Creative visual thinking reflected in graphic notations of compositions: Sound-focus and structure-focus types

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Abstract

The purpose of the study was to identify types of visual thinking from the use of graphic notations in compositions, and their relationship to creativity. Four sets of data were collected from Australian and Korean subjects ($N = 69$), comprising 42 Australian (22 seventh-grade, 20 university freshman music education) and 27 Korean students (18 seventh-grade, 9 ninth-grade). They were asked to compose music using graphic notations in groups of about 10 students. A set of graphic patterns developed by Walker (e.g., 1978, 1987) was used as examples of graphic symbols that students could use, but they were also encouraged to invent their own symbols. The students were given a maximum of 30 minutes, and used instruments of their choice, including voice. The compositions were videotape-recorded, and their graphic notations were analyzed into types of thinking used in organizing sound. Results showed that creativity scores were significantly related to notations which were focused on structure more than on sonic elements. Female subjects showed significant correlations between creativity scores and both sound-type and structural type notations. Effects of age and choice of sound source were also apparent.

Introduction

Review of Literature

Different types of thinking reflected in the use of visual shapes by children were explained in Arnheim (1969). The different types of thinking described by Arnheim were different ways of representing the world as seen through the eyes of children from many different countries, and as represented in different uses of visual representations for such ordinary items as the child's house, parents, animals, and so on. Arnheim coined the term visual thinking to provide a psychological platform for explaining how children not only view the world differently from adults, but represent it differently according to their different ways of interpreting the importance, or lack of it, of the physical features they see, as compared with adults. Use of visual space by children in their representations varied considerably, especially when given freedom to express themselves in visual space.

In the early 1970s, Walker (1978) experimented with several types of invented visual notations for musical sounds employing both children and adults, some musically trained and some inexperienced. Later studies (e.g. Bamberger, 1981) tended to restrict the use of graphic notations to representing traditional musical elements. In contrast, Walker used no such restrictions, and found a rich source of information about how subjects think in sound and represent this graphically. Walker (1987) found that musically inexperienced subjects tended to focus on a greater variety of sounds as compared with experienced musicians, which was reflected in the visual notations for sound they produced. Like Arnheim (1969), Walker (1978, 1981) found that younger children tended to think differently about sound, as compared with adults, and reflect this in their use of visual symbols for sound. The decade of the 1970s was a time when the experimental music of art musicians throughout the 20th century had permeated the world of popular music. The use of noise, the prominence of non-pitched percussion instruments, the increasingly experimental use of pitch, melody and harmony were all becoming popular in the entertainment arena. Most people had, by the 1970s, become accustomed to the wide range of novel sounds and new ways of using sound introduced from the earliest years of the 20th century by composers, such as Debussy, Webern, Russolo, Stravinsky and Varese onwards.

This new music reflected new ways of thinking in sound and musical structure. In turn, it quickly became apparent that the traditional staff notations, evolved over 1,000 years from Guido's first attempts, were increasingly unable to represent the new sound world that composers were using. As a result, composers began to invent their own notations. Many of these were graphic representations of new types of sounds. Walker (1978) began to experiment with different types of graphic notations to discover if there was any systematic relationship between visual deployment and the sonic elements it

represented. Certain basic relationships did emerge (Walker, 1978, 1985, 1987), but of importance to this study was the evidence that the use of graphic notations provided a relatively unrestricted platform for both the musically trained and inexperienced to compose music. Thus, the unrestricted use of graphic notations coupled with the unrestricted use of sound provided a much richer environment for studying thinking styles among composers than that provided by limiting subjects to the use of the musical sounds which staff notations traditionally represent.

However, certain effects of musical experience were observed. Walker (1978, and 1987) in his extensive studies of the use of graphic notations, both free and controlled, showed that the greater the musical experience with traditional staff notations, the less creative were the responses of such subjects when using graphic notations. For example, professional orchestral musicians in both studies cited tended not to take graphic notations seriously and to produce humorous or cynical responses. On the other hand, those subjects with limited formal musical training and experience found the use of graphic notations liberating and demonstrated original thinking. Auh (2000, and 2001) found similar responses in her study of students' use of graphic notations in among Korean and Australian students. More systematically, Auh found that creativity scores comparing trained and untrained subjects converged at the very highest and lowest end, but diverged significantly for the rest. The main function of staff notation is its use as a mnemonic. Graphic notations, in contrast, do not function in this manner.

Thinking styles have been theorized and researched by Sternberg (1997), which suggested that different people think differently and thus teachers should be aware of the different ways of thinking to be found in the individual students. Different thinking types were suggested in several musical composition studies: for example, expert versus novice compositional strategies (Colley, Banton, Down, & Pither, 1992), and horizontal versus vertical compositional strategies (Folkestad, Hargreaves, & Lindström, 1998). However, there are few studies on types of visual thinking that operate when composing music using graphic notations.

Purpose

The purpose of the study was to identify types of visual thinking in graphic notations of compositions and their relation to musical creativity. Three research questions were raised in this study:

1. Are there identifiable types of use of graphic notations in the compositions?
2. Are there significant relationships between the types of use of graphic notations and creativity in music compositions?
3. What are characteristics of the types of use of graphic notations by highly creative, average creative, and low (or less) creative musical compositions?

Definitions

Creativity, in this study, is defined as being original and excellent, whether in process, product, person, or environment [that facilitates creativity]. This definition is based on the one agreed upon by most psychologists (Sternberg and Lubart, 1999, p. 3). Graphic notation refers to pictorial representations of sounds.

Method

Subjects

Total number of subjects was 72; 42 Australian and 30 Korean students. The data were collected from various groups, details of which are shown in Table 1.

Table 1. Four Groups of Students from Australia and Korea

Designation	No. of Students	Nationality	Grade Level	Gender
A7	22	Australia	7th	All males
AU	20	Australia	University 1st yr	6males, 14 females
K7	18	Korea	7th	8 males, 10 females
K9	9	Korea	9th	All females

The students were recruited in their own countries, i.e., Korean students from Seoul, Korea, and Australian students from Sydney, Australia. Thus, results of the data should reflect cross-cultural aspects in creative visual thinking.

Composing music using graphic notations

Several decisions were made regarding the research design of this study. First, the students were asked to compose music in groups of 10 students, not individually nor in whole class. The groups of 10 students turned out to be most practical considering their school situations and the availability. Second, they chose musical instruments of their choice, instead of being given the same instrument for all students. The decision was made based on the research finding by Amabile (1984) that, when students were given

Third, they were asked to compose within a time frame of 30 minutes. Some qualitative researchers criticize the use of test conditions for creative activities, which they insist would hinder students' free exploration and thus creativity. However, a study investigating conditions of creativity tests (Hattie, 1980) showed that testlike conditions produced highest creativity for creativity tests among over 100 sixth-grade children, among three test conditions; i.e., 1) untimed, gamelike, 2) conventional testlike, 3) a medium condition between untimed and testlike. It suggests that a limited time can be a drive for finishing up products in a productive manner. Finally, the subjects were given the set of graphic patterns developed by Walker (1978), but also were encouraged to make their own graphic patterns, again reflecting the effects of choice in task materials found in Amabile (1984).

The composition testing was conducted in the following order: The students gathered in groups of 10 students during music class time or after school. They were given instructions on how to use graphic patterns to represent sounds, which were mainly asking questions to stimulate thinking, but avoiding any input from the researcher/instructor. Then, they were given 30 minutes to compose music using graphic notations and instruments of their choice. When they finished composing, they were asked to play their compositions, which were videotape-recorded by the researcher. The graphic notations of the compositions were collected for analysis.

Analysis of Data

The graphic notations were analyzed by two expert judges, comparing graphic patterns with their corresponding sounds recorded on videotape. The notations reflected students' thinking in composing music, and thus reflecting whether the students focused on structural elements or tone-quality. The expert judges used 5-point rating scales in quantifying the types of use of graphic notations in the students' compositions. Pearson product-moment correlations and ANOVA were used in statistical analyses.

Results

Research Question 1. Are there identifiable types of use of graphic notations in the compositions?

Three types of use of graphic notations (which will be called "GNU types", i.e., "Graphic Notation Usage" from now on) were identified: 1) Sound-focus type, 2) Structure-focus type, and 3) Effectiveness of either sound-focus or structure-focus. Sound-focus refers to the use of graphic notations which have a mimetic relationship between sound and visual symbol. Staff notations have no such relationship to sound. Structure-focus refers to notations, of any type, where a clear structure was observed. Effectiveness refers to how effectively the graphic images represent the images of sounds or structures in the compositions.

Research Question 2. Are there significant relationships between the types of use of graphic notations and creativity in music compositions?

The compositions were evaluated for their degrees for the three GNU types by 5-point rating scales. Then, the GNU type scores were correlated with musical creativity. In the analyzing process, two pairs of the GNU types were added, which were Sound+Effective (i.e., Sound-focus type and Effectiveness) and Structure+Effective (i.e., Structure-focus type and Effectiveness), since their combined scores would suggest important meanings based on previous findings. Results are reported for within each group and for all groups combined. Table 2 shows that, for all the groups combined, Structure-focus and Effectiveness were significantly related to musical creativity. Australian 7th graders and Korean 7th graders did not show any significant use for the five categories of the use of graphic notations, while Australian university students and

Table 2. Correlations between Musical Creativity and the GNU Types

M.Creativity and GNU Types	All groups Combined	A7	AU	K7	K9
M.Creativity – Sound-focus	.02	.05	.43	-.05	.68*
M.Creativity – Structure-focus	.27*	.04	.38	.18	.73*
M.Creativity – Effectiveness	.24*	.15	.59**	-.03	.65
M.Creativity – Sound+Effective	.14	.11	.56**	-.04	.67*
M.Creativity – Structure+Effective	.28*	.12	.51*	.07	.69*

*p < .05 **p < .01

Korean 9th graders showed significant uses of them.

ANOVA and Fishers' PLSD tests were computed to see if there were significant differences in the GNU types use among the four groups and where the differences occurred, respectively. The results showed that Australian university students were significantly higher in Sound-focus type than other groups of students ($F = 3.24$, $p = .0276$). For the other types, no significant differences occurred among the groups.

Gender effect on relationships between musical creativity and the GNU types was suspected due to all the non-significance of the Australian 7th graders and high correlation coefficients of the all-female Korean 9th graders. Pearson product-moment correlations were computed for the relationships within all the females of the groups combined and within all the males of the groups combined. The results showed that males' scores showed no significant relationships for all of the 5 GNU types and musical creativity, while females' scores showed significant relationships for all of the 5 GNU types and musical creativity ($p < .05$). Thus, it suggests that gender is a significant factor in the use of GNU types.

Research Question 3. What are characteristics of the types of use of graphic notations by highly creative, average creative, and low (or less) creative musical compositions?

The GNU types for highly creative, average creative, and low creative students were compiled, and ANOVA was computed to see whether significant differences occurred by the groups and the GNU types, and whether there were any interaction effects by the two variables. The results (see Table 3) showed that significant differences in GNU type scores were all due to groups, i.e., A7, AU, K7, and K9, and there were no significant differences due to GNU types. No interaction effects were observed in the results. Table 3 and Figure 1 shows that, in highly creative compositions, the GNU types

Table 3. ANOVA Table for GNU Differences by Groups and GNU Types for Students with High, Average, and Low Creativity

1. Highly Creative Compositions

Category	*Df*	*SS*	*MS*	*F*	*p*
Group	3	45.58	15.19	14.93	< .0001
GNU Type	4	.62	.15	.15	N.S.
Group x GNU Type	12	6.03	.50	.49	N.S.
Residual	90	91.59	1.02		

Table 3 (continued)

2. Average Creative Compositions

Category	*Df*	*SS*	*MS*	*F*	*p*
Group	3	36.15	12.05	6.42	.0006
GNU Type	4	.67	.17	.09	N.S.
Group x GNU Type	12	5.02	.42	.22	N.S.
Residual	80	150.07	1.88		

3. Low Creative Compositions

Category	*Df*	*SS*	*MS*	*F*	*p*
Group	3	7.64	2.55	1.30	N.S.
GNU Type	4	.06	.02	.01	N.S.
Group x GNU Type	12	6.98	.58	.30	N.S.
Residual	115	225.25	1.96		

Note: The students were divided into high, average, and low creative students within their groups, then they were compared for differences as a whole group.

significantly improved by age among Australian and Korean students. In average creative compositions, the GNU types significantly improved by age among Australian students, but that was not the case among Korean students. In low creative compositions, the GNU types did not show any patterns in both Australian and Korean students. When comparing Australian 7th graders and Korean 7th graders cross-culturally , there were no significant differences in all of the high, average, and low creative compositions.

Discussion

Some interesting observations can be made from the results. Overall, significant correlations were observed between creativity scores and use of structure-type notations together with the effectiveness scores in matching sounds with graphic notations. Effects of age, as predicted in earlier studies in use of graphic notations (e.g. Walker, 1978 and 1987) were observed, especially between Australian University (AU) and Australian Grade 7 (G7) subjects. Assessment of the use of Structure-type notations with those subjects with high creativity scores was higher than those with low creativity scores. In comparison by gender the female subjects showed significant correlations between creativity scores and all 3 notational categories, whereas with the males all comparisons were non-significant. This might suggest that the females were more flexible in their thinking than the males. Interestingly, there were no significant differences observed between the scores of the all-female Korean Grade 9 (K9) group and the Australian University (AU) group.

There were mitigating factors which may have affected some results. For example, the Korean Grade 7 (all male) group performed their pieces exclusively on recorders, and while some students displayed high levels of creativity, such limitations in sounds available probably had some effect. In contrast, the Korean Grade 9 group (all female) performed on a variety of instruments ranging across cello, piano, singing, violin, flute, clarinet, etc. Consequently the range of sounds they produced was much wider in scope. No significant differences in the types of visual thinking were observed by culture. Further studies are need to investigate developmental and cross-cultural perspectives in creative visual thinking.

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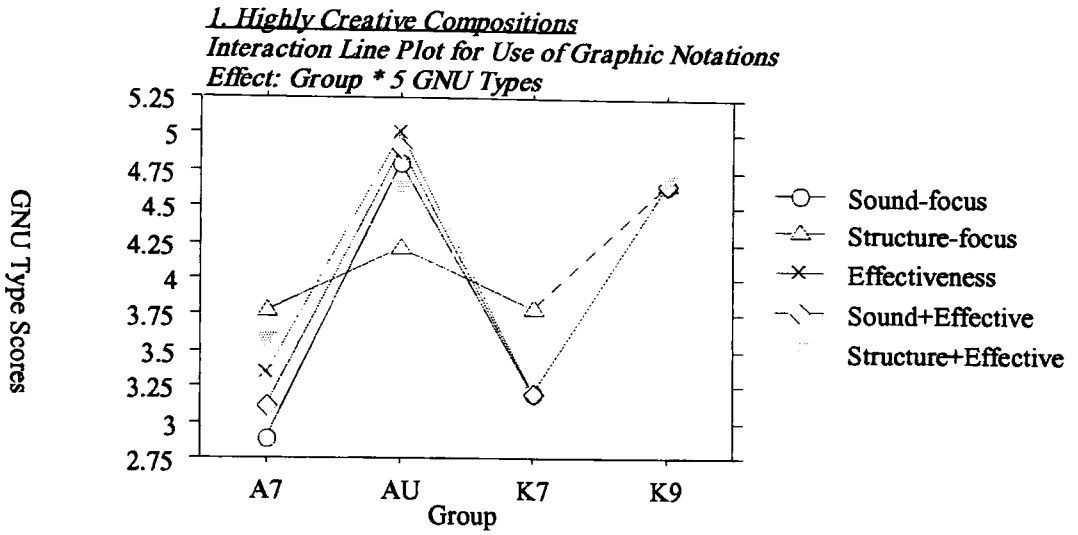

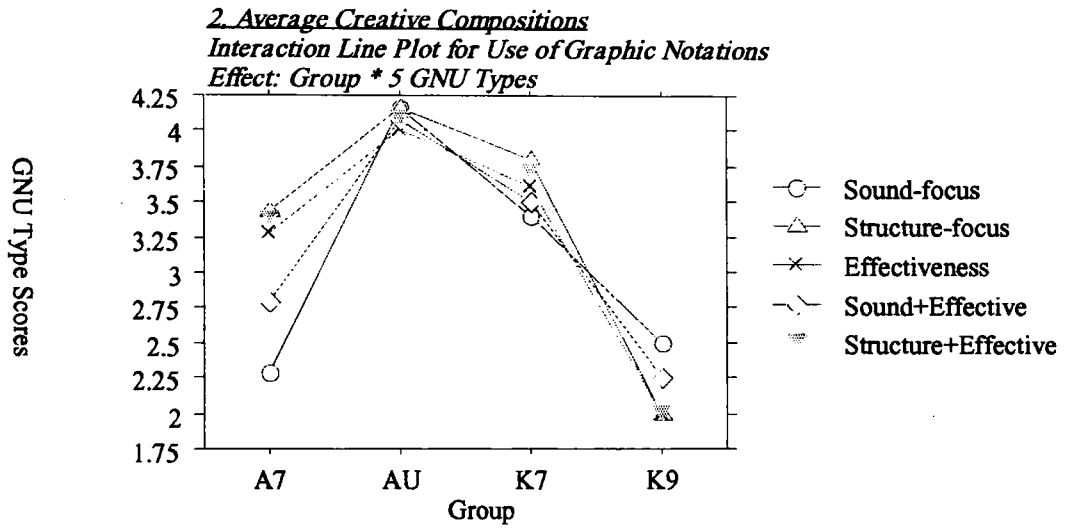

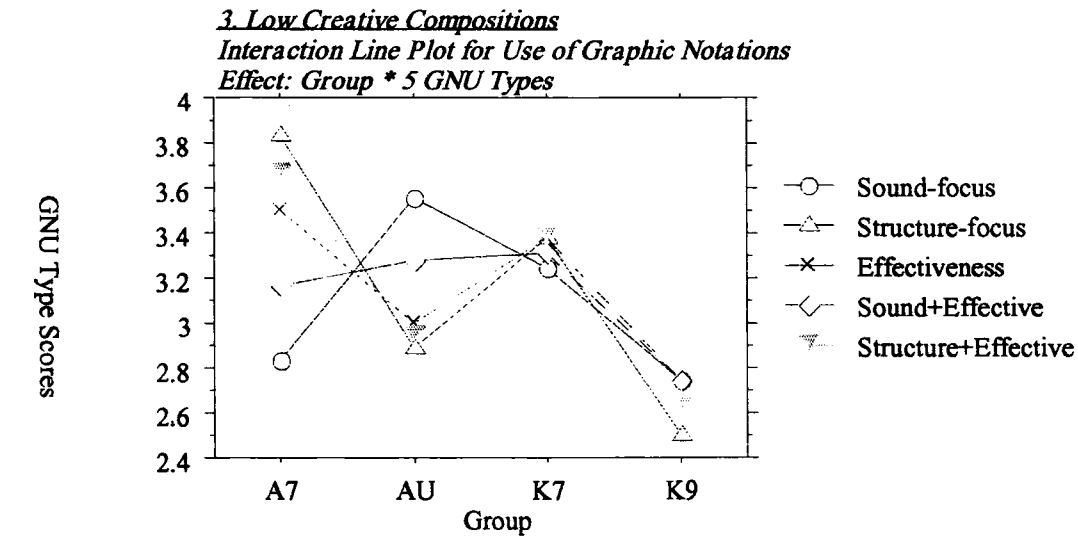

Figure 1. Comparisons of the GNU Types by high, average, and low creative

compositions.