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ABSTRACT

The purpose of this in-progress study is to try to find commonalities between visual proficiency and artistic performance. In order to assess visual proficiency, a test of spatial ability is being developed and pilot tested. Student performance on the test will be recorded and examined in relation to two traditional measures of student art performance: teacher assessment of ability (anecdotal and report card) and through administration of Clark's Drawing Abilities Test. This assessment tool is related to two arenas of professional interest. The first is the examination of the active operations of visual thinking by a variety of examples from psychological tests. The second is the difficulty in the identification of visually gifted children by classroom teachers without art training. The development and pilot testing of the new assessment tool, the tasks of which are revisions of Seymour's "Visual Thinking" activities, is outlined; and 13 visual abilities assessed through the test tasks are listed. Spatial visualization and spatial orientation are defined, and an overview is given of the assessment of children's spatial abilities. In summary, it is noted that the test being developed is not intended as a stand-alone assessment of visual abilities or proficiency, but rather a means of providing a single focused view to be considered in relation to other assessments. (Contains 16 references.) (MAS)

What is the Relationship Between Artistic Performance and Visual Proficiency?

Barbara W. Fredette

OVERVIEW OF STUDY

The purpose of this current study is to attempt to find commonalities between visual proficiency and artistic performance. In order to assess visual proficiency a test of spatial ability as generic visual skills was developed and pilot tested with intermediate level elementary school students. Their performance on the test has been recorded and will be examined in relation to two measures of their performance in art. One of these is their art teacher's assessment of their ability (anecdotal and report card) and the other will be through the administration of Clark's Drawing Abilities Test. Results will be examined to determine if there is a relationship between the assessment of specific visual skills and that of the visual abilities practiced through artistic performance. In addition, a goal of this effort is to find operationally valid support for the transferability of artistic performance to other domains and, eventually, to vocational goals. The report which follows is of the progress of this endeavor.

EXAMINATION OF TERMS

In order to communicate it is important to agree on definitions especially if they are honorific or stipulative. For the purposes of this study visual proficiency refers to spatial abilities which in turn are subsumed as exemplary of spatial cognition or intelligence. Currently any reference to spatial intelligence reminds the reader of Gardner's Theory of Multiple Intelligences. Gardner (1983) decided not to use the sensory mode of vision as a prefix to his identification of spatial intelligence. However he uses visual-spatial examples to demonstrate this intelligence. Although artistic ability may represent an example of the use of spatial intelligence, spatial intelligence is more comprehensive, more inclusive of a variety of visual abilities or skills. The concern of this study is to examine the overlap, if any exists, between visual proficiency assessed as visual skills and artistic performance assessed through the production of art, or more specifically drawing.

PRECEDENT FOR ASSESSING SPATIAL ABILITIES

There is a history to the measurement of spatial abilities as the mental manipulation of spatial relations. As early as the 1920's and through the 1930's factor analytic studies found a mathematically distinct spatial factor (McGee 1979). The first clear evidence for the existence of spatial "abilities" came in 1947 when Humphreys analyzed the results of thousands of tests given to military personnel (McGee 1979).

Two spatial factors emerged from this study. They were spatial visualization and spatial relations. Visualization was described as requiring an ability to imagine the rotation of depicted objects, the folding or unfolding of flat patterns, the relative changes of position of objects in space or the motion of machinery. Spatial relations was described as involving comprehension of the arrangement of elements within a visual stimulus pattern (McGee, 1979, p. 17). Several of the studies cited by McGee were conducted with school age children as early as second grade. McGee examined historical as well as recent (70's) studies and came to the conclusion that there was "strong and consistent support" for the existence of at least two distinct spatial abilities (p.3).

The two abilities McGee (1979) identified are spatial visualization and spatial orientation. His descriptions of the two abilities are useful toward developing an understanding of the mental activity required by each. He writes that:

> **Spatial visualization** is an ability to mentally manipulate, rotate, twist or invert pictorially presented visual stimuli. The underlying ability seems to involve a process of recognition, retention, and recall of a configuration in which there is movement among the internal parts of the configuration, or of an object manipulated in three-dimensional space, or the folding or unfolding of flat patterns (McGee, 1979, p. 3).

If this is considered from the standpoint of a perceiver and the phenomena which is being perceived then **spatial visualization** represents mental manipulation of what is being perceived. The second type, **spatial orientation,** requires (mental) movement of the perceiver. The ability to determine spatial orientation with respect to one's body. McGee tells us that:

> **Spatial orientation** involves the comprehension of the arrangement of elements within a visual stimulus pattern, the aptitude for remaining unconfused by the changing orientations in which a configuration may be presented, and the ability to determine spatial relations in which the body orientation of the observer is an essential part of the problem (McGee, 1979, p. 4).

Both spatial visualization and spatial orientation should be considered in a comprehensive assessment of visual abilities. It may be that spatial orientation can best be assessed by means of the representational drawing tasks identified by Clark's Drawing

Abilities Test (Clark, 1989) or Project Spectrum's Assigned Drawings (Gardner, 1993). The assessment of spatial visualization may be accomplished through use of the Visual Abilities Test which is being developed.

The examination of visual skills as spatial intelligence factors related to art production has occurred in at least one higher education setting. McWhinnie (1994) reported on a ten year study of the spatial intelligence factors of a group of 130 art students at the Maryland Institute, College of Art in Baltimore, Maryland. His reported findings for the early years of the study were that spatial test scores (if the highest and lowest were considered) were as predictable of student success in foundational art courses as teacher evaluations. Further, it was found that among the students tested there were two major modes of spatial intelligence which were 1). Analytical and 2) Holistic. The ones determined to be analytical had the highest scores on the 7 spatial tasks while the Holistic scored the lowest. From these results it appears that the spatial abilities sampled in the test tasks may use a high level of thinking process. This calls for further investigation.

McWhinnie also reported that Johns Hopkins Center for Gifted and Talented has adapted a spatial dimensionality test. He reported on a 1990 experimental version which included items from several sources. Embedded figures, card rotations, surface development and copying test items were from ETS, rotations test items were from Elliot-Price, perspective items were from Stumpf and paper folding items were from SOI. A vocabulary test (ETS) was included for psychometric purposes. The samples shown by McWhinnie indicated that these tests consisted of black and white line drawing "test" type items. It appears that the dimension of spatial abilities as visual proficiency is being given consideration in the identification of the gifted and talented. To what extent a value for visual abilities may surface in the current national assessment effort may warrant further scrutiny.

The major purpose of the study being reported here is not to identify or to discriminate among individual students but to determine what overlap, if any, exists between two different assessment approaches to spatial abilities. In the development of his drawing abilities test, which was designed to identify artistically gifted students; Clark (1989) compared the results of his test with those of the CEFT (Children's Embedded Figures Test). Although no significant correlation was found there was an overlap. Embedded figures is a cognitive style test of visual ability but it measures this ability in only one of the number of visual abilities which may be assessed. The assessment instrument being developed examines a range of visual abilities.

THE ASSESSMENT OF CHILDREN'S SPATIAL ABILITIES

In their writings and research, spatial cognitivists Bailystok & Olson (1983) have established that art experiences contribute profoundly to

the acquired functional capabilities within the spatial intelligence realm. Contemporary authors such as Eisner (1985) Perkins (1994) and Gardner (1991) have emphasized the cognitive aspects of visual art by declaring that it as an important and valid way of knowing. Furthermore, these authors suggest that artistic abilities may underlie performance in other content areas such as science and math.

A problem with establishing these connections lies in the fact that artistic performance exemplifying facility in this way of knowing tends to be assessed by essentially aesthetic rather than cognitive criteria. The transferability or generalizability of artistic performance to other contents needs to be demonstrated. An important outgrowth of such a demonstration would be to reinforce the notion that art learning should be accessible to **all** students. The connections between the visual abilities revealed and practiced through artistic performance and those used in domains other than art should be investigated.

Gardner (1983) reminds us that the concrete operations of Piaget's theory marks the turning point in mental development which means that the child is now able to actively manipulate objects and images in the spatial realm. He is capable of reversible mental operations so that he can identify how objects would look to people approaching them from different viewpoints and he can indicate how a room would look to someone seated in different parts of the room or "how an object would look if rotated in space" this spatial intelligence is "still restricted to concrete situations and events" (p.179). If the spatial intelligence referred to by Gardner is not a general factor but is instead comprised of two or more types of abilities such as visual orientation and visual manipulation than assessment of visual ability should be designed to accommodate the variety.

Another theory which contributes support to this assessment effort is the notion of fluid and crystallized abilities which may be used in combination in solving the spatial intelligence tasks (Lohman, 1990). Fluid abilities are brought into use when engaged in novel problem solving tasks such as spatial tasks which require the child to reason with novel figure or symbolic stimuli. Simultaneous processing refers to the mental ability of the child to integrate input all at once to solve a problem correctly. Simultaneous processing frequently involves spatial, analogic or organizational abilities. Spatial or figural reasoning tasks continue to play a prominent role as measures of general cognitive abilities such as those considered to be fluid measures factors. When dealing with young students we are focused on fluid intelligence and its assessment.

DEVELOPMENT, USE AND PRELIMINARY RESULTS OF THE INSTRUMENT

In light of today's educational reforms it may appear that the development of a test is a retro effort. Why would anyone be interested in developing a test of skills when educational assessment in general, and

at all levels, is becoming process/ portfolio oriented? The justification for this effort is tied to the recognition that portfolio reviewers are engaged in the act of interpretation. Interpretation in the area of spatial cognition may be assisted through reiterative or overlapping documentation.

The development of this assessment tool came about as an outgrowth of two arenas of professional interest. In a graduate course in Visual Thinking visual skills are a frequent topic of discussion. McKim's (1980) examination of the active operations of visual thinking is illustrated by a variety of examples from psychological tests. These examples are labeled in ways which imply categorical variations of visual thinking skills.

In addition to McKim's analysis of test items students are given the opportunity to examine two sets of VISUAL THINKING CARDS developed by Dale Seymour (1983). These activity cards were developed to provide students, from grades 3 through 12, with opportunities to practice the spatial perception skills represented by them. Seymour categorizes the cards by what he calls "concepts". Seymour's cards are very similar to the tasks found in psychological tests of spatial ability except that they are colored which appears to make them more appealing to students. Both the McKim and the Seymour materials have been explored by students as part of an inquiry process directed to the question "where do you practice these skills in real life situations". Besides the identification of common perceptual events, the areas of art as well as math were frequently identified in response to this question. Professional curiosity about the relationship between visual proficiency in spatial abilities and artistic performance followed.

The second arena of professional interest which led to this present effort is that of the identification of visually gifted children. The evolution of this continuing effort has been reported elsewhere (see Fredette 1994, Fredette, 1993). It was noted (Fredette, 1994) that classroom teachers, without art training, find it difficult to assess the cognitive or intellectual efforts represented in children's drawings. Furthermore they tend not to see artistic effort exemplified by drawing ability as more than drawing well. They do not see it as evidence of high level intellectual ability.

Children's drawings are a window on the mind, not a window on the world, but adults, outside of art teachers and enlightened parents, find it very difficult to assess the thinking exemplified in children's drawings. It may be due to their level of aesthetic development (see Michael Parsons, 1991) or to their level of visual literacy, but the results are detrimental to the identification of high levels of thinking that can be evident in the child's free drawings. On the other hand, general IQ tests include visual skill items--there is a precedent for their acceptance as evidence of cognitive ability. If we can document a positive relationship between the two it may serve to change the attitudes of non-art oriented persons

to the cognitive abilities exemplified in children's drawing.

In order to look more closely at what is meant by visual ability, a test of generic visual skills is being developed with the assistance of a doctoral student, Eunjoe Lee Chae. The first version of the assessment instrument was given to a small group of intermediate level students who volunteered to take it in their free time. A revised version was developed and it has been pilot tested with students representing grade levels four and five. At this time their performance on the test has been examined in relation to their art teacher's assessment of their ability (anecdotal and report card).

A second assessment, which is not as yet completed, will be through the use of Clark's test of Artistic Giftedness. Much work remains to be done. A second revision of the visual proficiency assessment is called for. The nascent preliminary results which are available appear to justify the identification of specific visual skills exhibited in and practiced by artistic performance. The identification of these skills may, in turn, lend support to the transferability of artistic performance to other domains and, eventually, to vocational goals.

The experimental version of the test which has been developed consists of 5 pages with 4 cells or tasks on each page. The tasks are revisions of Seymour's VISUAL THINKING activities. Early in 1994 Dale Seymour was contacted by telephone. He was asked if any research had been done using the Thinking Cards. The response was no, but that he would be interested in any study which might develop. The specific tasks were selected to exemplify a variety of visual spatial abilities. (See Figure 1 at the end of this article for a list of the visual abilities to be assessed). The selected tasks also included attention to spatial orientation as well as spatial visualization (see McGee, 1979). Other considerations in the selection were the interests of intermediate level children such as codes and mazes. Note: examples of the tasks which represent each of these operational descriptions can be found in the experimental version of the visual abilities test which has been designed. However due to the problem of copyright the specific examples cannot be shown here as illustrations.

The small (6) group of fifth grade children who 'tried out' the test were quite enthusiastic about it. A few minor changes to facilitate group administration of the test were made before it was given to a combined fourth and fifth grade class. Due to scheduling problems, this test administration was a very recent event. Twenty-four students took the test. Their scores were analyzed in relation to a four point index of talent derived from the art teachers anecdotal report. Boxplots were made of the data. A more robust comparison will be made when Report Card data is available as well as the results of the Clark Test of Drawing Ability. In the meantime an item analysis revealed that no items had all correct responses and no items were missed by all 24 students. Further analysis in terms of type of visual

ability the task samples is underway.

In summary it should be noted that the "test" being developed is not intended as a stand alone assessment of visual abilities or proficiency. It is a means of providing a single focused view which must be considered in relation to other assessments of an individual student. Some dimensions are lacking in the current test which we will put into place if another version is warranted. A metacognitive element may be included in the form of a question which asks the student to reflect upon the test they have just taken and describe their opinion of the kind of mental efforts the tasks required.

Mrs. LeeChae, the doctoral student who produced the experimental test and the necessary copies from a computer file had to overcome the problems inherent in the production, printing and copying of color graphic files. Her student allowance of computer file space was used up rather quickly. The extent to which full color is necessary as more than a motivator will need to be considered. But before that comes into consideration a more comprehensive answer to the initiating question; What is the relationship of artistic ability to visual proficiency; must be found. It may be true in this, as in many searches, that the road traveled is the major result.

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VISUAL ABILITIES

Ability to imagine:
the rotation of depicted objects
the folding or unfolding of flat patterns the relative changes of position of objects in space

Pattern comprehension; the ability to match the edges of figures with the corresponding elements in other figures

Ability to locate simple shapes within complex shapes

Ability to match similar shapes regardless of size or spatial orientation.

Ability to recognize shape in spite of shared boundaries

Spatial visualization:
the ability to visualize the resultant pattern when folded and cut

Ability to manipulate 3D objects in (mental) space

Ability to locate points and estimate directions

Ability to imagine movement through a complex pattern (maze)

Ability to estimate relative size in spite of surrounding elements

Ability to visualize a configuration in which there is movement in the internal parts of it

Ability to manipulate or transform the image of spatial patterns into other arrangements

Ability to discount the effect of context (illusion)

Figure 1. Visual abilities assessed through test tasks.

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