Scientific Research Publishing

Psychology, 2019, 10, 96-105
http://www.scirp.org/journal/psych
ISSN Online: 2152-7199
ISSN Print: 2152-7180

Developmental Level Measurement with a Star-Wave Test for Children, with Yalon's Maturity (M) Scale

Shogo Komatsu

Kanagawa Prefectural General Education Center, Kanagawa, Japan
Email: look.what.happened.7700@gmail.com

How to cite this paper: Komatsu, S. (2019). Developmental Level Measurement with a Star-Wave Test for Children, with Yalon's Maturity (M) Scale. *Psychology, 10,* 96-105.
https://doi.org/10.4236/psych.2019.101008

Received: December 14, 2018
Accepted: January 27, 2019
Published: January 30, 2019

Abstract

With the star-wave test, Maturity (M) Scale invented by Yalon and Zion allows you to utilize as evaluation standards for necessary general developmental skill for school education. A low score on the M scale indicates that the learning ability is underdeveloped, and also indicates the existence of developmental delays such as intellectual impairment and learning disability or organ problems. In this study, we apply the star-wave drawing test to 134 young children in Japan and compare the data between 5-year-olds from Japan and 5-year-olds from Israel to see the applicability of the M scale proposed by Yalon and Zion in other countries. In terms of M scale, we conducted a t-test to see if there is any gap among average scores between Japanese 5-year-olds and Israeli 5-year-olds. The significant difference was recognized at the 5% level; it turned out that Japanese 5-year-olds got much higher M scale scores than Israeli 5-year-olds. This fact shows that the M scale reflects the developmental standard for children in Japan. Also, by examining drawing characteristics made by the normal children and handicapped children (intellectually handicapped children, down syndrome children, cerebral palsy), the relationship between the M scale and the intellectual ability or writing motion function of the children was confirmed.

Keywords

Star-Wave Test, Projection Drawing Method, Infancy, Developmental Maturity Scale, Distress Scale

1. Introduction

Star-wave test is to draw "ocean waves and starry sky" with pencils on the paper

with a printed 10.5 × 15.3 cm rectangle frame. Lallemant, AU (1984) mainly proposed handwriting analysis for the screenings as "developmental functional test" for preschool children. After a while, he found out that personality characteristic can be grasped by introducing Jungian psychology, and began to use regardless of the ages.

The drawing analysis consists of 3 handwritten elements, 1) wave movement, 2) shape of star, 3) spatial arrangement. Instead, Lallemant proposed following 5 steps for analysis:

a) Drawing classification: a. only points; b. painterly; c. emotional; d. formal; e. symbolic; total 5 types.

b) Structure of space: a. harmony; b. apposition; c. regularity; d. disharmony; total 4 types.

c) The symbolic expression of space: 7 kinds of analysis for the vertical direction, 4 kinds of analysis for horizontal analysis. The vertical direction is classified into a. harmony of sky and sea; b. sky's predominance; c. sea's predominance; d. sky and sea on the horizon; e. the gap between sky and sea; f. emphasized space between sky and sea; g. mixed. Horizontal analysis is classified into a. no emphasis; b. emphasis on the left; c. emphasis on the middle; d. emphasis on the right.

d) Symbol of things: Analyze symbolic meanings of stars, waves, rocks and cliffs, islands, boats, moon, coast, lighthouse and so on.

e) Handwriting: There are 6 ways of drawing lines: Single line; shaking line; stable line; unstable line; continuous line; and shredding line. There are 8 types to stroke: General lines (delicate lines, sharp lines, soft lines, and solid lines), lines with signs of obstacles (narrow lines, hard lines, fragile lines, and cluttered lines).

Additionally, we analyze whether there is a black trace of stuck handwriting and trace of handwriting falling apart as a sign of disability. As a research of star-wave test in Japan, there is "star-wave test trial in Japan (as a developmental functional test for school children)" Kyoko, S., Yasuaki, S., Hideto, M., & Kaoru, N. and Research-Aid Paper of the Yasuda life Welfare foundation (1998).

Kyoko, S. and Hideto, M. (1998) released "star-wave test trial in Japan" in the bulletin 24 of basic science, Nippon medical school in 1998, also "star-wave test as a development functional test: Drawing by Kindergarten Children" as a document in 1999. Rhyner, B., Kyoko, S., & Yasuaki, S. (2000) published the book "star-wave test introduction" in 2000.

Kyoko, S., & Ryuta, K. (2012) published the book "projection drawing method test battery star-wave test/Walteg Drawing Test/Baum Test" advocated. Thus, the practice and research of SWT has undergone various developments during the past quarter century. As one of them, Dafna Yalon (2006) from Israel published "The star-wave test across the life span-advances in theory", Research and Practice in 2006. The Japanese translation (2015) "Development of star-wave test theory, research and practice: Across the Lifespan" was published. Together with Zion (Ben-Zion), Yalon conducted SWT on preschool children and created ma-

turity (M) scale and distress (D) scale. These scales were not created to conclude and label disabled children but created to find children who need individual support sooner and provide the support. This M scale can be used as an evaluation standard of general development skills necessary for school education. And the low score reflects underdeveloped learning ability which could mean intellectual impairment, learning disability, as well as the developmental delay or the existence of organ problems. Also, the quality of waves is said to be able to predict the difficulty of academic performance and sociality, especially writing disturbance. As for D scale, the high score means that the child is suffering from stress at least for a certain period of time. The reasons are as follows: 1) physical: mild neuropathic disorder, low muscle tension, clumsy pencil holding etc. 2) environmental: neglect, divorce, bereavement, etc. 3) psychological: a decline in self-esteem, anxiety, perfectionism, etc.

Yalon and Zion retested in a few years to conduct an empirical study to predict the risk of atypical development (developmental disorder), suggesting its possibility.

However, in terms of M scale and D scale, Yalon and Zion advocated as an SWT developmental function, there is almost no research seen whether this method is applicable in other countries or not.

2. Objective

In this study, we examine the applicability of M scale Yalon and Zion advocated in other countries to be the evaluation standard of general developmental skill necessary for school education by conducting a star-wave test on 5-year-olds and 6-year-olds from Japan to assess the differences in M scale score.

In addition, we examine the differences in M scale and D scale scores between 5-year-olds from Japan and 5-year-olds from Israel. Lastly, we have healthy children get diagnosed at a medical institution, and examine the differences in drawing characteristics and M scale for children with intellectual or physical disabilities.

3. Method

3.1. Participants

74 subjects aged 5 attending nursery school, 60 children aged 6, a total of 134 subjects. Subjects came to nursery school on the day and targeted children who had written consent beforehand to parents. As for this case, we examined one intellectually handicapped child undergoing diagnosis at a medical institution, one with down syndrome, and one with cerebral palsy withdrawing.

3.2. Research Date

SWT was conducted on 50 subjects from nursery school A in January 2016, 40 subjects from nursery school B in July 2017, 44 subjects from nursery school C in February 2018.

3.3. Research Tools

SWT paper (frame inner dimension 15.3 × 10.3 cm, frame thickness 1 mm), one HB pencil, eraser and pencil sharpener.

3.4. Procedure

SWT was conducted with group method at nursery school A in January 2016, nursery school B in July 2017, nursery school C in February 2018 (about 12 - 13 subjects aged 5 and 6 in one room with one tester and assistant). The testers were two clinical psychologists and two psychological assistants. After communicating with subjects "Do you know the stars in the sky? Do you know the waves of the ocean?", they asked the subjects "Please draw the stars and the waves of the ocean". In advance, they asked to fill in their personal information (number, DOB, age with years and months, and special remarks) to use numbers, not names. Only the nursery school has the numbers that identify the individual as an ethical consideration, the researchers have not been informed. Data are kept in a locker for 5 years.

3.5. Analysis Method

Drawing judgment was conducted on 134 subjects by 2 clinical psychologists who did the research on drawing and regularly used drawing test at the clinical site. After they calculated M scale and D scale of individual drawing, they consulted and confirmed the scores at the meeting. Scoring methods for M scale and D scale are as follows.

[Scoring method for M scale] Calculate from 5 items (Table 1). Highest score total 10 points, average score 6 points, and less than 5 points are a low score.

1) Comprehension of task: whether star and wave are drawn or not. If yes, the score is 2 points, 1 point if partially drawn, if not 0 points (same applies as below).

2) Shape of a star: 2 points if drawn, 1 point for round star or circled star.

3) Wave movement: 2 points if drawn; 1 point if linear, awkward, and arch type.

4) Spatial arrangement: 2 points for stars on the upper part, waves of the sea on the lower part, 1 point if partially drawn.

5) Acknowledgment of the frame and qualitative level, 2 points in both.

a) Acknowledgment of frame: 1 point if drawn within the frame and drawn out of the frame only one time. 0 point if drawn outside of the frame more than 2 times.

b) Qualitative level: 1 point for preliminary characteristics (sustainability, recognition, effort, self-confidence), 0 points for lack of preliminary characteristics, disturbance factors (laziness, abandonment, negligence, inactivity, dreamy).

6) Comprehension of task: whether star and wave are drawn or not. If yes, the score is 2 points, 1 point if partially drawn, if not 0 points (same applies as below).

7) Shape of a star: 2 points if drawn, 1 point for round star or circled star.

8) Wave movement: 2 points if drawn; 1 point if linear, awkward, and arch type.

9) Spatial arrangement: 2 points for stars on the upper part, waves of the sea on the lower part, 1 point if partially drawn.

Table 1. The maturity scale.

The Maturity Scale
Task Understanding
2—stars placed over the wave with different, recognisable forms
2—relevant additions (fish, boat, moon, etc.)
1—stars only
1—waves only
1—just one star, huge and centrally placed
1—irrelevent additions (flower, butterfly, sun, etc.)
0—another drawing
0—an empty sheet
Form of Stars
2—at least one well-formed angular star
1—a planned angular form, with malformations due to impaired movement
1—round stars, good circles
0—form disturbances
0—scribbles, no forms
0—lack of stars
Movement of Waves
2—at last one rhythmically wave
1—linear or angular (zigzag) strokes
1—arcades
1—other static forms
0—movement disturbances (sometimes only in the waves)
0—blacking of wave-area
0—lack of waves
Spatial Arrangement
2—stars placed over waves with good macrostructure
2—stars over waves with stars placed in a row (typical for children at age five)
1—upper part with stars, lower part empty
1—disturbed macrostructure
0—spatial problems: waves over stars, or side by side
0—stars all over the sheet
0—waves all over the sheet
0—stars and waves on one side of the frame only
Frame Recognition
1—drawing within the frame, or one deviation
0—two deviations or more outside the frame
Qualitative Level
1—anxiliary qualities (persistence, ideas, diligence, self-asurance, or any trait that might help coping in school)
0—lack of such auxiliay qualities, or even occurrence of disturbing factors (indolence, giving up, slackness, dullnes, fantasm, etc.)

10) Acknowledgment of the frame and qualitative level, 2 points in both.

a) Acknowledgment of frame: 1 point if drawn within the frame and drawn out of the frame only one time. 0 point if drawn outside of the frame more than 2 times.

b) Qualitative level: 1 point for preliminary characteristics (sustainability, recognition, effort, self-confidence), 0 points for lack of preliminary characteristics, disturbance factors (laziness, abandonment, negligence, inactivity, dreamy).

[Scoring method for D scale] Calculate from 5 items, subordinate items are 21 items (Table 2). Total 42 points, average 5 points, and more than 6 points are a high score.

1) Primary sign indicating weakness (loose movement, etc. 4 items).

2) Primary signature of uncontrollable impulses (3 items such as fragile handwriting).

3) Secondary sign of tension (7 items such as narrowing).

4) Secondary signature of over-guarantee control (high regularity, etc. 3 items).

Table 2. The distress scale.

The Distress Scale
SIGNS OF DISTRESS
Primary Signs (Weakness)
1. Slack motion
2. Slack, non-elastic stroke
3. Fragile stroke
4. Stroke interruption (uncontrolled breaks)
Primary Signs (Uncontrolled Drives)
5. Spongy stroke
6. Crude stroke
7. Hyperkinesis
Secondary Signs (Tension)
8. Narrowness
9. Cover Strokes
10. Contracted movement
11. Tense, non-elastic stroke
12. Hard stroke
13. Corrections by retouching and easing
14. Fixational blackening
Secondary Signs (Overcompensating Control)
15. Very regular arrangement
16. Stylisation, from interpretation of the test
17. Hatching of the plane
Maladjustment to the Environment
18. Disrupted space, disharmonious, empty areas
19. Entanglements
20. Final blocking
21. Roughing of the pla

5) The sign of environmental maladjustment (4 items such as discordant space) for above 21 items, 2 points if it is strong or high frequency, and 1 point if it is weak or up to 2 times.

4. Results

The average scores for M scale and D scale of 5-year-old, 6-year-old from Japan and 5-year-old from Israel are shown in the chart (Table 3). It is assumed that a total of 134 people in Japan are 5-year old children (74), 6-year old (60), a population of Japanese children. We tested Israel's 5-year old child (314) assuming that it is a population of Israeli children.

1) M scale examination of 5-year-old and 6-year-old from Japan.

As for M scale, a t-test was conducted on 5-year-old and 6-year-old from Japan to see the gap between average scores. As a result, the difference was observed at the 1% level, M scale score on the 6-year-old was significantly higher than the 5-year-old ($t(132) = 2.582$ $p < 0.01$) (Table 4).

2) M scale examination of 5-year-old from Japan and 5-year-old from Israel.

As for M scale, a t-test was conducted on 5-year-old from Japan and 5-year-old from Israel to see the gap between average scores. As a result, the difference was observed at the 5% level, M scale score on the 5-year-old from Japan was significantly higher than the 5-year-old from Israel ($t(73) = 2.136$ $p < 0.05$.) For this test, a t-test was conducted on the sample using the average value of Israel's 5-year-old child described in Yalon (2006) (Table 5).

3) D scale examination of 5-year-oldfrom Japan and 5-year-olds from Israel.

As for D scale, a t-test was conducted on 5-year-old from Japan and 5-year-old from Israel to see the gap between average scores. As a result, the difference was observed at the 1% level, M scale score on the 5-year-old from Japan was significantly higher than the 5-year-old from Israel ($t(73) = 4.529$ $p < 0.01$) (Table 6).

4) Examination by case studies of healthy children and handicapped children.

The outline of the case used in this research and the descriptive features of M scale score and drawings are as follows:

Table 3. The average scores for M scale and D scale of 5-year-old, 6-year-oldfrom Japan and 5-year-old from Israel.

	5-year-old from Japan (n = 74)	6-year-old from Japan (n = 60)	5-year-old from Israel (n = 314)
M scale	6.53	7.55	5.98
D scale	6.41	5.41	5.00

Table 4. t-test for M scale on 5-year-old and 6-year-old from Japan.

	5-year-old (n = 74)	6-year-old (n = 60)	t
	M (SD)	M (SD)	
M scale	**6.53 (2.19)**	**7.55 (1.91)**	**2.58***

*$p < 0.01$.

Table 5. t-test by one sanple for M scale on 5-year-old from Japan and 5-year-old from Israel.

	5-year-old from Japan (n = 74)	5-year-old from Israel (n = 314)	t
	M (SD)	M	
M scale	6.53 (2.19)	5.98	2.14*

*$p < 0.05$.

Table 6. t-test by one sample for D scale on 5-year-old from Japan and 5-year-old from Israel.

	5-year-old from Japan (n = 74)	5-year-old from Israel (n = 314)	t
	M(SD)	M	
D scale	6.41 (2.66)	5.00	4.53*

*$p < 0.01$.

a) (Healthy child) a girl aged 6 years and 3 months, M scale 10 points.

Stars and waves of the sea are drawn well-balanced. There are two types of well-shaped stars at the top; four waves with motion are drawn on the lower half of the paper.

b) (Intellectually handicapped child) a boy aged 5 years and 2 months, M scale 0 point.

Overall drawn cluttered and dirty; Stars and waves can't be distinguished; protruding from the frame is noticeable.

c) (Child with down syndrome) a boy aged 5 years and 3 months, M scale 3 points.

You can barely recognize stars and waves, but stroke is very unstable and cluttered. The spatial arrangement between stars and waves is mixed.

d) (Child with cerebral palsy, no delay in intellectual ability) a girl aged 6 years and 9 months, M scale 2 points.

Overall stroke is very weak and cluttered; the shape of stars and waves are not recognizable. Difficult to define what is drawn.

5. Consideration

1) M scale examination of 5-year-old and 6-year-old from Japan.

In Japan, 6-year-old had significantly higher M scale scores than 5-year-old. According to the research of SWT Lallemant AU (1984) conducted on 721 subjects from daycare in Germany, it is hard to address disability by the drawings from 3-year-old, but become possible by the drawing from 4-year-old, and finally the test can be completed by leaving some exceptions due to developmental delay or disability once they are 5 years old.

Also, when the function matures and becomes fully compliant with the test, it can also distinguish whether there is an obstacle in the depicted picture. It also states that it will appear more clearly at the age of 6 and 7. As for developmental function research by Kyoko, S., & Hideto, M. (1999), Japanese children start to

draw stars and waves at the age of 4 and 5 sufficiently; 90% of 6-year-old or older are able to draw completely. Based on this previous study, the M scale reflects the developmental level of children.

2) M scale examination of 5-year-old from Japan and 5-year-old from Israel.

From the developmental point of view, it was considered that the M scale does not reflect the cultural difference, but in the comparison between Japanese 5-year-old and Israeli 5-year-old, 5-year-old from Japan had significantly higher scores than 5-year-old from Israel.

However, clear scoring standards are set for just these 4 items (1. comprehension of the task, 2. shape of the star, 3. wave movement, 4. spatial arrangement) out of 5 items that constitute M scale. So, it will be the same whoever rates these 4 items. As for 5, qualitative standard, there is no defined scoring standard, so it's highly possible to score differently depends on the rater. Thus, the scoring method could differ between Japan and Israel based on this fact and affect the M scale score. We think it's necessary to clarify the evaluation method of qualitative level from now on so that there would be no difference among raters.

3) D scale examination of 5-year-old from Japan and 5-year-old from Israel.

When we examined D scale, Japanese 5-year-old had significantly higher scores than Israeli 5-year-old. D scale seems to reflect the psychological distress. Hence, Japanese 5-year-old children are feeling more stress than Israeli 5-year-old children. It is possible that Japanese society may have a structure that causes more stress and pain than Israel for children.

4) Examination of the case of healthy children and handicapped children.

In the drawing by healthy child A, stars and waves are clearly drawn and M scale score is 10 points which are expected to be the standard for 6-year-old children. From the evaluation by the daycare teacher, it doesn't seem to have a particular problem. Also, 5-year-old children must be able to draw stars and waves as well. However, the common features of B, C, and D are cluttered, hard to distinguish stars and waves and all have low M scale score. As for B and C, they have delays in intellectual ability, underdeveloped learning ability for the same aged children. As for D, no delay in intellectual ability, but there are restrictions on writing movement function due to cerebral palsy, not being able to draw stars and waves as B and C did. Additionally, writing pressure seems very weak compared to B and C. As a conclusion, M scale score is related to intellectual abilities or writing motion function.

6. Summary and Challenges for the Future

In this research, the relation between M scale Yalon and Zion was advocated, and the developmental level of children was confirmed. Also, we were able to clarify the relation between M scale and intellectual ability or writing motion function. From these things, The Star-Wave Test is a simple paper-based test that can be taught easily, which enables its group-based implementation for preschool children and indicates its effectiveness as a screening test. Moreover, the

use of the M scale enables quantitative evaluation of the level of developmental functions of preschool children.

However, it is necessary to set evaluation criteria more clearly in the future for 5 qualitative level, one of the evaluation items. Yalon and Zion advocate the relation between M scale and learning disability, but this particular matter hasn't been examined yet in this research. We think it's important to verify M scale and other drawing characteristics in the future in order to apply SWT to earlier detection and support for children with learning disabilities.

Acknowledgements

I would like to thank Ms. Kyoko Sugiura, Mr. Ryuta Kanemaru, Mr. Yasuaki Suzuki and Ms. Tomoko Aoki for their advice and guidance to conclude this thesis.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Kyoko, S., & Hideto, M. (1998). Star-Wave Test Trial in Japan). *The Bulletin 24 from Japan Medical University Basic Science, 27,* 5-32.

Kyoko, S., & Hideto, M. (1999). The Star Wave Test as a Developmental Functional Test: Drawing by Kindergarten Children. *The Bulletin 27 from Japan Medical University Basic Science, 27,* 19-43.

Kyoko, S., & Ryuta, K. (2012). *Projection Drawing Method Test Battery Star-Wave Drawing Test/Walteg Drawing Test/Baum Test.* Tokyo: Kawashima Bookstore.

Kyoko, S., Yasuaki, S., Hideto, M., & Kaoru, N. (1998). *Star-Wave Test Trial in Japan—as A Developmental Functional Test for School Children* (pp. 102-103). Research-Aid Paper of the Yasuda Life Welfare Foundation.

Lallemant, U. (1984). *The Star-Wave-Test.* Munchen Studienkreis, Ausdruckswissenschaft.

Rhyner, B., Kyoko, S., & Yasuaki, S. (2000). *Star-Wave Test Introduction*. Tokyo: Kawashima Bookstore.

Yalon, D. (2006). *The Star-Wave Test across the Life Span-Advances in Theory, Research, and Practice-Lorraine Hebert.* International Graphological Colloquium.