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Draw a Person: Intellectual Ability Test for Chilldren, Adolescents, and Adults – The Potential for Screening Diagnostic of Selected Cognitive Abilities

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Abstract

The goal of the study was to verify potential of human figure drawing for screening diagnostics of cognitive abilities i.e. how it could be reflected in human figure drawing memory, verbal and nonverbal intellectual abilities. Sample consisted of 50 adult participants in the age from 21 to 49 years (M=29). There were used methods Draw-A-Person – Intellectual Ability Test for Children, Adolescents and Adults (DAP: IQ, evaluated by three evaluators) memory test LGT3 Form A and test of intellect structure in shortened version ISA-S. Previous findings put performance in DAP: IQ into connection especially with nonverbal abilities, the so called fluid intelligence. Thanks to comparison of rough score in abovementioned methods it could be stated that in quality of elaboration are reflected, in some extent, also memory abilities (DAP: IQ and LGT3). We did not find, though, any relation to elements covering crystalline intelligence with the exception of memory subtest that is a part of ISA-S.

Key words: Human figure drawing, memory, fluid intelligence, crystalline intelligence.

INTRODUCTION

Drawing of human figure remains for more than 100 years in repertoire of psychologists (also of non-psychologists) to assess various parts of personality in various fields of psychological practice (see e.g. review Piotrowski 2015). Despite obstinate opponents (Gregory 1992, Motta et al. 1993 or Lilienfeld, Wood, Garb 2000) it has still its advocates (e.g.Yama 1990, Hibbard 2003, Piotrowski 2015). Basal arguments in favour of human figure use are especially speed, time, material and financial modesty, possibility for use on various population under any conditions either individually or in groups of children and adults. Rejection of drawing is based especially on the fact that prerequisites - especially projective attitude to drawing – were not verified and conclusions were very unconvincing (what subsequently had an influence on a view on human figure drawing as a whole). But the position – projective versus non-projective use could be considered as outdated in present and we may distinguish several specific mutually diametrically different attitudes (more details see Jurovaty, Demuthova 2022):

- Performance approach – it is a connection of incidence of basic elements, features of drawing with the level of intellectual abilities when quality of drawing, way of its execution reflects development of mental level, perception, fine motoric ability… (see Goodenough 1926, Harris 1963, more in detail see later).
- Projective approach – individual characteristics of drawing offer information for knowledge of personality structure (person that is drawing identifies with drawn figure and he/she projects into it its own qualities, aspirations, visions about the world). There are assessed individual details (single sign attitude), their execution (head, its shape, hands…) as well as formal elements (succession, line, space, and size characteristics… e.g. drawing of teeth as aggressive sign, pipe, mallet, tie as sexual symbols…). It is supposed that through a drawing it is possible to look inside into hide, unconscious processes of a human being with the help of analysis of two drawings (man and woman) what also enables to picture relations to other sex, to itself (more see Machoverova 1949, Altrusch 1963, Hammer 1958, Ogdon 1978 and others that developed and worked up the idea of Machoverova).

- Global or the so-called multiple sign approach – it is not done analysis of individual isolated signs and conclusions according to them are not done but they are done through cumulation of signs of specific category. Primary goal is to detect emotional and behavioural problems of children (Koppitz 1968, Naglieri, Bardos, Meneish 1991, in our country Svancara, Svancarova 1964) and is based on facts what is and what is not usual in a drawing of a child of some age (e.g. presence of transparencies, extremely small figures, empty eyes, but also basic elements of a drawing – nose, hands, head are omitted…). If occurs "exceptional" sign it could represent warning emotional indicator, if a sign of some group occurs repeatedly (summation) probability of emotional problems increases.
- Typological approach – drawing is assessed as a whole and complex interpretation or motif of elaboration (e.g. contour drawing, stick drawing, suit drawing…) is important. First indications of such use we could see in works of Machoverova (1949) and Ogdon (1978), who speak about soldiers, stick drawings, clowns, nude figure, and to the respective drawing they assign personal characteristics. In our environment, their own interpretations were made by Koubek (2007) which were aimed at psychiatric population (he presents hysterical, schizophrenic, organic type) or Jurovaty (2011) on "normal" population presents contour, suit, nude… types.
- Dynamic approach – the main advocate of dynamic approach is Hardi (1992). He repeatedly collects drawing from one subject in various time sections and follows objective changes in drawing elaboration that give evidence on progress of a disease, treatment, effects of therapy (every improvement or deterioration of a state could be consequently seen on a drawing). Emphasis is laid on evident content or formal changes (drawing becomes more proportional, more elaborated, and more "logical" according to improvement of mental state), it is omitted intuitive or symbolic assessment.

Every of abovementioned approaches to drawing presents its own ways of how to see a drawing, it is aimed at specific elements, elaboration, and especially - anyone is aimed at different features of personality and deduces different conclusions. All of them, though, have one thing common: they use for an assessment a human figure drawn by a pencil on a paper. Existence of several approaches still leaves drawing of a human figure in the center of interest of psychologists also from the view of research – they do not want to give it up and they look for new possibilities of use of its potential to make concepts that could be in reality better used and could be more productively utilized. It should be mentioned that drawing of a human figure offers wider possibilities of use than it was mentioned. For better representation, we can mention e.g. use of human figure drawing in relation to cognitive style (Gigi 2016) to identify dementia of older people (Wang, Ericsson, Winbland, Fratiglioni 1998), research of patients with cognitive damage (Mitchel, Trent, MacArthur, 1993), comparison of individuals with autistic disorder with the so-called "normal population" (Papangelo, Pinzino, Pelagatti, Fabbri-Destro, Narzisi, 2020).

HUMAN FIGURE DRAWING AS PERFORMANCE TEST

Test of human figure drawing as a "promising" tool to diagnosing cognitive abilities was introduced by Florence Goodenaugh. In her pioneering work "Measurement of Intelligence by Drawings" (1926) she scientifically worked out an idea of relation of a child development (from 3 to 13.5 years) and development of drawing (with the increasing age of a child more details could be seen, it is being developed elaboration of a drawing and proportionality) and as the first one, she presented psychometric study on connection of drawing and intelligence where she quantified drawing development. Her scientific attitude reflected creation of scoring system (Draw-A-Man - DAMT), in which she specified characteristics (in total 51 differentiating characteristics that are to be monitored) for individual age groups which have to be included in standard drawing (assessment of characteristics occurrence by points is used for detection of rough score and following transformation on values of intelligence quotient that represents usual equivalent of current tests procedures). According to the author, especially mental ability (the most important factor) but also motorial ability, coordination eye-hand, perception, and imagination are responsible for the way and quality of drawing realization.

In the same way continued also Goodenaugh fellow worker Dale B. Harris (Goodenaugh-Harris Drawing Test, GHT, 1963). He was aware of the need to work out standards, to specify categories what had a consequence that it was made a system using three drawings (man, woman, person himself/herself) – it should depict development of personal figure scheme) through which he modified original approach of Goodenaugh (drawing only one figure of a man). Effort to understand drawing and use its potential more sophistically was presented in assessment of 73 elements of a drawing what, on the other side, was more complex during evaluation of results. Contribution of Harris system is creation of standards for sex, prolongation of age that could be used to 15 years, and introduction of the so-called "deviation" IQ (Average 100, deviation 15). According to made researchers (Carvajal, McVey, Seelers, Weyl; and, McKnab 1987, Abel, Heiberger, Johnson 1994, Aikman, Belter, Finch 1992 and others), it should be stated that popularity of clear use of human figure drawing with "exact" evaluation rules, with simple realization has risen rapidly. Also in our environment, there were efforts to standardize this method (Sturma, Vagnerova 1982, Figure drawing) for the use for the age from 3.5 to 11 years with assessment of content characteristics (15 items aimed at presence of a characteristic – eyes, nose, hands …) and formal characteristics (20 items aimed at dimensions, proportions, symmetry).

With drawing of a human figure it had been intensively worked also during further years, there had been formed and specified

instruction, way of assessment, there had been adjusted statistic processing. Koppitz (Quantitative Scoring System, QSS, 1968) specified 15 essential characteristics of drawing that could be find in works of 85 % of children of a respective age and 11 extraordinary characteristics that could be find in works of maximum 16 % of children of a respective age. She returned to presentation of only one figure and again she considers mental level of a child as the most important ability that appears in a drawing of a child.

Increase in complexity of evaluation schemes and because of that also higher possibility of arguable results caused in the course of time simplification and increase of evaluation explicitness. Naglieri (1988, Draw-A-Person: A Quantitatve Scoring System – DAP: QSS) then presented only 14 categories (hands, ears, eyes, fingers, hair…) in which are evaluated not only occurrence but also quality of elaboration and it adds some bonus points, while there are evaluated three drawings: man, woman and a child himself/herself. He "polished" statistic processing, standards, average rough score in every quarter, standard differences and he came up to 17 years of age. The important contribution is the fact it takes into account not only sex but also social and economic variables (profession of parents, family income), ethnic differences. Naglieri`s approach could be considered as the "most important" when speaking about his popularity in psychological community. Also, researches executed in the last time using just Naglieri`s scheme proved that (e.g. Troncone 2014, Rehring 2015, Rehring, Stromswold, 2017, Troncone, Chianese, Di Leva, Grasso, Cascella, 2020).

All the above-mentioned approaches were aimed only at children, adult population had been skeptically omitted and it was interesting, especially for projective application. In 2004 the authors Reynolds and Hickman created Draw-A-Person – Intellectual Ability Test for Children, Adolescents, and Adults – DAP: IQ. Even from the title results that in its use it is not limited only on population of children but also on adults. They represent the first and so far the only approach usable from 4 up to 90 years of age. Authors connect drawing of a human figure with the so-called fluid intelligence (with cognitive abilities especially in non-verbal level). Their scheme represents compromise of existing score schemes: they evaluate 23 characteristics (head, eyes, hair, hands, fingers, legs, clothes …) on a scale 0 – 4 points in dependence on quality of elaboration and that only for one figure of oneself. Importance is laid on instruction that is more motivational than instruction of preceding authors "Draw a figure of yourself in a best way you are able". Transfer charts for various age categories through which we can transfer acquired rough score to intelligence quotient are a part of manual. As their approach is based on fluid intelligence, also acquired rough score transferred to intelligence quotient, copies development of fluid intelligence (increase up to 15 years of age, then stabilization, gradual decrease after 25 years of age, and rapid worsening in old age (Cattel, 1987, Flanagan, Motta, 2003).

Presented performance approach is based on explicitly specified rules that relate to drawing assignment, way of its assessment, scoring, and finally also transfer of rough score to intelligence quotient with minimizing space for subjective influences. Efforts to reach accuracy caused elimination of speculations and it clearly increased test reliability and generally simplified the use. Creators of performance systems presented high rate of reliability. Authors of abovementioned DAP: IQ discuss Cronbach alfa in the interval 0.74 – 0.87 for individual age categories (Reynolds, Hickman, 2004), while for all age categories in total, it reaches value 0.82. Though also other authors come to similar findings (e.g.Williams, Fall, Eaves, Woods-Grooves, 2006) when recorded level 0.82 on a sample of 110 university students or Khasu, Williams 2016 on a sample of Malawi children come to alfa coefficient 0.81, in our area Jurovaty, Demuthova, 2022 recorded on a sample of 50 adults with a use of three evaluators values 0.777, 0.740 and 0.761. In test-retest reliability, the authors (Reynolds, Hickman 2004) use values 0.84 and for inter-rater reliability, they present values 0.91-0.95 (Reynolds, Hickman 2004). Also Williams, Fall, Eaves, Woods-Groves (2006) present for inter-rater reliability value 0.83, Khasu and Williams (2016) 0.85. Higher values presented Honores, Merino (2011): 0.91 and Rehring, Stromswold (2017): 0.94. In our environment Jurovaty, Demuthova (2022) recorded values 0.893 to 0.951 at $p < 0.001$. Results point out to high reliability of DAP: IQ.

Research of validity, the main characteristics for which we want to use the test, though, was not so definite. Even if authors speak about correlation 0.33 if speaking about verbal factors, 0.49 if speaking about performance factors and 0.46 for total IQ if Weschler scale was used (Reynolds, Hickman 2004), verification of their findings by other authors was, at least, problematic, often not in harmony with presented findings - e.g. Imuta, Scarf, Pharo, Hayne (2013) also speak about high reliability of a tool, but correlations in relation to intelligence took by Weschler scale is average at best and that only for children – factually they find out relation to nonverbal subtest coding - to others no, but on a sample of 100 adult probands in age from 19 to 49 years they found no correlation. The biggest criticism was aimed at ability of the instrument to differentiate individuals with low and vice versa with high intelligence (border zones) where Imuta, Scarf, Pharo, Hayne (2013) assess it as insufficient, inconvenient.

Also "older" versions of performance understanding of human figure drawing did not present always convincing findings connected to test validity (if we do not take into account the authors and acceptable findings presented by them). Findings are variable either if speaking about DAMT (Reisman, Yamakoski, 1973), GHT (Abell, Wood, Liebman, 2001, Sutter, Bishop, 1986) DAP: QSS (Abell, Wood, Liebman, 2001, Lassiter, Bardos, 1995, Wisniewski, Naglieri, 1985,) DAP: IQ (Willcock, Imuta, Hanye, 2011, Khasu, 2016 and others). Troncone (2014) with the use of colour progressive matrix RFPM acquired significant relation for DAP: QSS from $p = 0.33$ up to $p = 0.44$ (in relation to drawn figure) and for GHT $p = 0.29$ - 0.35 at $p<0.01$. Imuta, Scarf, Pharo, Hayne (2013) in harmony with findings point out to weak ability to discriminate border zones and do not recommend to use human figure drawing as an isolated tool to measure intelligence (similarly also Willcok, Imuta, Hayne, 2011).

PROBLEM

Motta et al. is an intensive critic of human figure drawing use for testing of personality, emotional damage, or intelligence when he points put at inconsistent low level of relation between drawing and intelligence measured by standardized tests, as well as on very weak ability to predicate academic performance. He considers it for invalid and useless tool. This critique caused discussion between supporters (Bardos, 1993, Naglieri, 1993, Holtzman, 1993) and opponents (Gresham, 1993, Kamphaus, 1993, Motta, Little, Tobin, 1993, Lilienfeld, Wood, Garb, 2000) of human figure drawing. Controversy of method is, though, not an obstacle for its further use and research of possibilities to be used. Interest is supported by new and new researches, findings of which are not always fruitless (e.g. Imuta, Scarf, Pharo, Hayne, 2013, Troncone, 2014, Jurovaty, Demuthova, 2022). Current situation in the field of human figure drawing use as performance test could be characterized as slightly chaotic. Despite efforts to clear distribution of points and minimize space for subjective stakes it is necessary to point out that there have been used various abovementioned systems (DAM, GHT, QSS, DAP: QSS, DAP: IQ), in them it is drawn one, two, or three figures, there are missing re-standardizations (i.e. there have been compared standards acquired e.g. 30 years ago with actual data and at that it was pointed out by e.g. Velez-van-Meerbeke, Halliday, Talero-Gutiérez (2011), there are no taken into account at least basic differential criteria (with which the authors of original manuals did not work) such as sex, age, education. It doesn`t exist one standardized method, there is no complete harmony of assessed elements. Contradictory statements that result from it are obvious.

The last contribution DAP: IQ has tried to eliminate many imperfections – to include new standards, to work also with variables such as age up to adulthood (as basic revolutionary view), education, and that all with effort to reach better, more practical, more exact use of human figure drawing. Desire to eliminate imperfections was evident in effort to specify clear evaluation parameters that are holders of information on cognitive abilities of normal population. Researches reflecting incorporated modifications and their proving, including certification of psychometric qualities, are not very common and if we take into account "normal" adult population they are in fact exceptional (with the exception of Imuta, Scarf, Pharo, Hayne, 2013 or Khasu, Williams, 2016 Fall, Eaves, Woods-Grooves, 2006). Majority of researches have been done on children or on individuals with some "disruption" of cognitive abilities (e.g. Kuttner, Kuttner, Chromekova, 2013).

There are not so much researches that are aimed on verification DAP: IQ, intelligence, and other cognitive abilities. This field is relatively little covered especially when speaking about adult population and it seems it exist a space for research verification. Investigation of DAP: IQ validity is then still a challenge. It seems that basic problem is if human figure drawing is connected to verbal or performance elements if it is connected to fluid or crystalline intelligence or if in the way of adults drawing are proved also other cognitive abilities. Attitude towards nonverbal abilities seems to be most probable and it was proved in study elaborated by us (Jurovaty, Demuthova 2022) but possible relation to other cognitive abilities – verbal, memory, and their reflection in drawing is questionable. Hardy (1992) emphasizes importance of knowledge level, abilities, given conditions, and intelligence for drawing quality – adults will draw figure on a level to which they came at the last state of their development. So drawing also has to reflect level of perception, imagination (how a figure has to look like), memory, attention but also some personal adjustment. And so inspection of possible relations of DAP: IQ test to other cognitive abilities in adult population represents the main goal of this study.

METHODS

Sample

Basic group consists of 50 participants – 31 men and 19 women, their age is between 21 and 48 years, average age 29 years. Education analysis: 19 participants has secondary education (SE - 39%), 31 university education (UE - 61%) (Table 1). Most of persons were 21 to 30 years old. Selection of persons into basic group was done through decision by a lot from the total number of 754 drawings i.e. by random choice. Persons took part in the period 2018-2021 in selective procedure to various positions in civil field and in force departments in various areas of the Slovak republic.

Table 1 Selected characteristics of research sample

	SE	%	UD	%	Σ	%
Men	13	42	18	58	31	61
Women	6	32	13	68	19	39
Σ	19	39	31	61	50	100

Instruments

DAP: IQ (Reymonds, Hickman, 2004) – human figure drawing usable from 4 to 79 years 11 months and 30 days of age where it is evaluated figure under 23 specified basic criteria (figure parts: head, hair, eyes, eyebrows, nose, mouth, chin, ears, neck, arms, hands, palms, body, waist, hips, legs, knees, ankles, soles, clothes, and accessories) that are evaluated by points according to manual in compliance with quality of elaboration – more points correspond to more advanced and better elaboration of respective part of a body (points 0 to 4 in accordance to detail). Total score then represents summation of points acquired for elaboration of individual parts of body that is then converted according to age tables to intelligence quotient. Persons were given information according to manual to draw a figure of himself/herself best as he/she can. As modified assignment, it was further set to draw a figure of the opposite sex that was evaluated according to the same criteria with the goal to "verify" stability of findings.

ISA-S (Fay, Trost, Gittler, 2001) - Test of structure of general intellectual abilities including 9 subtests (Completing sentences –SE, Finding of common features –GF, Remembering goods – WM, Completion of numerical

sequences – ZF, Exposure of relations-BE, Cubes recognition -WE, Practical sums – PR, Creation of concepts –BB, Composition of figures - FZ). Test is aimed at functions of intelligence connected to speech and calculation, to measure figural imagination and observational abilities. It was used S version with 12 tasks in every subtest. Intellectual abilities were also monitored on total verbal (V-including SE, GF, BE, BB subtests), numerical (Nu – including subtests ZF, PR), nonverbal (N- including subtests WE, FZ), and total rough score (C), individually also subtest Remembering goods.

LGT3 – (Marsalkova, Mesarosova & Hrabovska, 1986 memory test consisting of six subtests: City plan, Vocabulary, Things, Phone numbers, Construction, Company marks) with ability to distinguish memory abilities of individuals in the area of verbal memory (V), nonverbal memory (N) and total rough score (C). After the part of adopting individual subtests in strictly given order and with specified instruction it follows phase of realization. For all the participants it was used Form A. We have verified the authorization to use the test LGT3 for adult population in the past on a sample of 287 participants from 20 to 59 years old, 153 men, 134 women at $r = 0.000$, $p < 0.001$ (Jurovaty 2022).

SPSS – Statistical Package for Social Sciences (IBM) - Statistical and analytic software used for realization of all the necessary statistical calculations.

Procedure and data analysis

All the tests (DAP: IQ, ISA-S, LGT3) had been assigned individually or for groups of three participants in a group, at maximum. At assignation it was acquired permission with anonymous results processing, there were met standard conditions as well as instruction. Administrator and evaluator was always a psychologist. Every participant has got his/her individual code that was used for further elaboration of acquired data and further it was operated only with assigned code. Motivation for the best performance was in fact the respective situation. It was a selection process where every participant could something won and something lose. Tests were evaluated in DAP: IQ by three evaluators marked as evaluator 1 (the longest psychological practice), 2,3 (the shortest psychological practice) without knowing data about evaluated participant and mutual knowledge of evaluation results. All the evaluators assessed two figures. Acquired rough score was used for further statistic processing. Tests ISA-S, LGT3 were evaluated according to patterns and also it was acquired rough score with which it was further worked. Basic methods of statistical processing were: descriptive statistics (average values, median, minimal and maximal values, standard difference), inference statistics (Spearman correlation coefficient, Pearson correlation coefficient).

RESULTS

Data on evaluated drawings for all the three evaluators (1,2,3) for the first and the second drawing are presented in Table 2 (average values, standard differences, median, minimal, and maximal values). In research, drawings were evaluated by three evaluators with the aim to also verify possible influence of subjective evaluation on results. Inter-rated reliability was observed on the level 0.893 -0.851 (Jurovaty, Demuthova 2022).

Table 2 Descriptive data for human figure drawing by three evaluators for the first figure and second figure

First Figure	**h1**	**h2**	**h3**
Mean	33,26	32,22	33,88
Median	34,00	33,00	35,50
Std. Deviation	5,67	4,82	5,37
Minimum	18,00	18,00	21,00
Maximum	43,00	40,00	42,00
Second Figure	**h1**	**h2**	**h3**
Mean	32,52	31,86	33,12
Median	33,50	33,00	34,00
Std. Deviation	5,84	5,09	5,59
Minimum	19,00	19,00	20,00
Maximum	42,00	40,00	42,00

Evaluation of the first and second figure (Table 3) was different on the whole in 44 cases – evaluator 1 awarded the first figure higher score than second in the case of 29 drawings. The same score he awarded in 6 cases. Evaluator 2 has more balanced evaluation when he awarded the first figure higher score than the second in the case of 21 drawings, in 19 cases the second figure has the higher score and the same score was awarded in 10 cases. Third evaluator awarded the same score to 13 drawings but 23 first drawing acquired higher score than second drawing.

Table 3 Evaluation of first and second figure by the three evaluators – Wilcoxon sign serial test

		N	Mean Rank	Sum of Ranks
h1B - h1A	Negatívne	29[a]	22,22	644,50
	Pozitívne	15[b]	23,03	345,50
	Zhodné	6[c]		
	Spolu	50		
h2B - h2A	Negatívne	21[d]	22,43	471,00
	Pozitívne	19[e]	18,37	349,00
	Zhodné	10[f]		
	Spolu	50		
h3B - h3A	Negatívne	23[g]	22,07	507,50

	Pozitívne	14[h]	13,96	195,50
	Zhodné	13[i]		
	Spolu	50		

We determined significant difference in evaluation of first and second figure only by evaluator 3 at the level p = 0.017 at p < 0.005 (Table 4), while the second figure was evaluated statistically by significantly smaller number of points than the first drawing.

Table 4 Results of Wilcoxon test - Evaluation of first and second figure

	h1B - h1A	h2B - h2A	h3B - h3A
Z	-1,765[b]	-,829[b]	-2,376[b]
Asymp. Sig. (2-tailed)	0,078	0,407	0,017

For "reflection" of memory monitored by LGT3 test (basic data are presented in Table 5) in the total rough score of DAP: I Q we also worked with values form all the three evaluators. By analysis of results HS in DAP: IQ and LGT3 test through non-parametric Spearman correlation coefficient rho (distribution of LGT3 data was not normal) we did not find any important relation either in relation to verbal, non-verbal part of memory or to total score in LGT3 test for no one of the three evaluators when speaking about the first figure – drawing of oneself (Table 6).

Table 5 Descriptive data for LGT3

	V	N	C
Mean	25,5200	27,8000	62,6200
Median	26,0000	28,5000	63,0000
Std. Deviation	8,24681	7,98468	15,48652
Minimum	9,00	7,00	28,00
Maximum	45,00	47,00	104,00

Table 6 Spearman correlation coefficient DAP: IQ and LGT3 for the first figure

	Spearman correlation coefficient		
	Verbal	Nonverbal	**Σ**
h1	0,097	0,099	0,051
h2	0,285	0,343	0,292
h3	0,223	0,214	0,217

In the case of second figure (subsequently, immediately drawn as opposite sex) it was monitored an important significant relation of the first elaborator in relation to total memory at the level p = 0.044 at p<0.05 (Table 7).

Table 7 Spearman correlation coefficient DAP: IQ and LGT3 for the second figure

	Spearman correlation coefficient		
	Verbal	Nonverbal	**Σ**
h1	0,069	0,105	0,044
h2	0,244	0,410	0,317
h3	0,088	0,310	0,143

We used Pearson parametric test to learn relation of human figure drawing to individual components of intellect acquired by ISA-S test (Table 8) – verbal, non-verbal, numeric, and total HS and simultaneously to find out how a drawing could be related with individual more specific intellectual abilities. Results proved only one significant relation - in category drawing oneself and only for one evaluator (Table 9) in relation to memory test for evaluator 2 at the level p = 0.019 at p<0.05 with medium rate of effect. **A**s it could be seen similar subtest approximated to importance also in the case of further two evaluators but it did not reach level of significant importance. In the case of second drawing, we found out significant relation to the memory subtest again by evaluator 2 at the level p = 0.004 at p<0.001.

Table 8 Descriptive data for ISA-S

		SE	GF	ZF	BE	WM	WE	PR	BB	FZ	V	Nu	N	C
N	Valid	50	50	50	50	50	50	50	50	50	50	50	50	50
	Missing	0	0	0	0	0	1	1	1	0	0	0	0	0
Mean		7,4082	6,7347	4,1837	6,2245	5,0612	2,8163	4,8980	5,7551	3,1020	25,6000	8,9000	5,8000	45,2600
Median		8,0000	7,0000	4,0000	6,0000	5,0000	2,0000	5,0000	6,0000	3,0000	26,0000	9,0000	5,0000	46,5000
Mode		8,00	7,00	4,00	2,00[a]	4,00	1,00	7,00	8,00	3,00	20,00	9,00	3,00[a]	30,00
Std. Deviation		1,95702	1,87944	3,19944	3,11759	2,83878	2,29740	3,06353	3,07226	2,19132	8,69201	5,64692	3,62531	17,59732
Minimum		3,00	3,00	0,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Maximum		12,00	10,00	12,00	12,00	12,00	9,00	12,00	11,00	8,00	43,00	24,00	14,00	80,00

Table 9 Pearson correlation coefficient DAP:IQ and ISA-S for the first figure and second figure

First Figure	**SE**	**GF**	**ZF**	**BE**	**WM**	**WE**	**PR**	**BB**	**FZ**	**V**	**Nu**	**N**	**C**

h1	Pearson Correlation	,132	-,144	,104	,044	,272	,122	-,009	,112	,181	-,054	-,005	,122	,029
	Sig. (2-tailed)	,366	,323	,478	,765	,059	,404	,949	,443	,213	,711	,973	,400	,842
h2	Pearson Correlation	,145	-,129	,101	,091	,334*	,156	-,042	,188	,140	,034	-,003	,143	,091
	Sig. (2-tailed)	,321	,376	,489	,532	,019	,283	,774	,195	,336	,817	,985	,323	,529
h3	Pearson Correlation	,148	-,151	,108	,029	,271	,107	-,065	,137	,056	-,023	-,019	,054	,028
	Sig. (2-tailed)	,309	,301	,460	,845	,060	,466	,655	,347	,703	,872	,898	,708	,845
Second Figure		**SE**	**GF**	**ZF**	**BE**	**WM**	**WE**	**PR**	**BB**	**FZ**	**V**	**Nu**	**N**	**C**
h1	Pearson Correlation	,166	-,171	,100	,034	,255	,062	,010	,199	,214	-,019	,007	,109	,045
	Sig. (2-tailed)	,255	,239	,496	,815	,077	,671	,943	,171	,140	,894	,962	,452	,755
h2	Pearson Correlation	,106	-,049	,134	,165	,400**		,202	,001	,266	,141	,088	,035	,168	,145
	Sig. (2-tailed)	,470	,737	,358	,258	,004		,165	,995	,065	,333	,543	,809	,245	,315
h3	Pearson Correlation	,087	-,156	,067	,063	,274	,099	-,071	,172	,060	-,008	-,041	,056	,030
	Sig. (2-tailed)	,552	,284	,647	,668	,057	,497	,627	,238	,682	,955	,777	,701	,836

DISCUSSION

Authors (Reynolds, Hickman, 2004) join performance in DAP: IQ with nonverbal abilities i.e. with the so-called fluid intelligence (similarly also Gooudenaugh, 1926, Harris, 1963, Naglieri, 1988). They speak about correlation at the level 0.49 when speaking about performance segments of intelligence and only about value 0.33 when speaking about verbal segments. When they used Weschler scale they acquired for total IQ correlation level 0.46. When they used other test of US provenience - Reynolds Intellectual Assessment Scales (RIAS, Reynolds, Kamphaus, 2003), they acquired verbal subtest correlation value 0.42, to motoric subtest they acquired 0.61. Different results were acquired by Imuta, Scarf, Pharo, Hanye, 2013. On a sample of 100 children the acquired partial correlation between DAP: IQ score and total performance in Weschler test (r =0.27, p = 0.007) but only one significant correlation in relation to nonverbal subtest Coding (includes copy of shapes) Weschler test (p = 0.029 at p < 0.001) but no one with relation to other subtests and that supports opinion that DAP: IQ is connected especially with measurement of general intellectual abilities and that it is more connected with nonverbal as verbal abilities. They, though, point out at a very weak ability of DAP: IQ test to discriminate children with boundary intelligence as well as talented children. On a sample of 100 adults with the use of Weschler scale, they did not obtain any significant correlation (r = 0.10, p = 0.32). Other authors also came to similar findings with the use of Weschler and Stanford-Binet test, but with the use of other score systems on human figure drawing also came other authors. Reisman and Yamakoski (1973) with the use of Goodenaugh`s DAMT, but again only on children, acquired correlation on the level of 0.36-0.40 at p <0.01, Sutter and Bishop (1986) in relation to coding 0.37 and understanding 0.15. If GHT was used they obtained a little better findings: Reisman and Yamakoski (1973) obtained correlation 0.44-0.50, Aikman, Belter, Finch, (1992) on clinic population 0.78-0.49 at p< 0.001. Naglieri`s system DAP: QSS (1988) was verified e.g. by Imuta, Hayne (2011) at p< 0.001 on the level 0.40, but also Wisniewski, Naglieri (1989) has found out in a group of children from 6 to 16 years old a correlation to the full scale in an interval 0.42-0.51 in relation to a type of a drawn figure. DAP: QSS was also used by other authors: Abell, Wood, Liebman (2001) in relation to WISC-R in an interval 0.46-0.55, Lassiter, Bardos (1995) in relation to WISC-R on a sample of 50 children at the level p = 0.30. So consistence of findings presented in literature is questionable, but we want to point out that we speak especially about researches on groups of children. Studies done with adults with the use of DAP: IQ are in fact rare.

Abovementioned “inadequate” findings in relation to crystalline intelligence create condition of bigger connection DAP:IQ to the so-called fluid intelligence what is supported not only by findings of DAP: IQ authors (Reynolds, Hickman) but also by other authors (Abell, Wood, Lieberman, 2010, Buck, 1970, Hardi, 1992, Arden, Trzaskowski, Garfield, Plomin, 2014), as well as findings in survey that was realized by us on a sample of 50 adults in relation to nonverbal test CF2A and we acquired correlation 0.29 – 0.37 at p<0.005 (Jurovaty, Demuthova, 2022). Also findings connected to preceding versions of human figure drawing support this opinion. Naglieri (1988) in connection to Matrix Analogies Test has found out a correlation in an interval p = 0.28 – 0.31, Prewet, Bardos, Naglieri (1988) at the level p = 0.35-0.50, Haddad, Juliano (1991) p = 0.32. From newer studies, Troncone (2014) verified GHT, DAP: QSS and has also used Raven colour progressive matrixes (RFPM) on a sample of 184 children while she found out

positive and significant relation not only between GHT and DAP: QSS ($p = 0.81$ for a man and $p = 0.693$ for a woman at $p<0.01$), but also in relation with RFPM score (in relation to drawn figure at DAP: QSS from $p = 0.33$ to $p = 0.44$ and at GHT in an interval 0.29 – 0.35 at $p<0.01$). Connection of human figure drawing to fluid intelligence is presented also by Kubierski (in Harris 1963) and it is supported also by other authors e.g. Gilbert and Hall, 1974, Ericson in Maserati et al, 2018. Critical studies point out especially on "weak" correlations between human figure and other tools to measure intelligence (e.g. Motta, Little, Tobin, 1993), while paradoxically they support their opinions on findings in relation to tests collecting crystalline intelligence and not to findings related to fluid intelligence.

Relation of human figure drawing - evaluated through DAP: IQ scheme (Reynolds, Hickman, 2004) and memory is not so clear. We came to partial findings through the use of three evaluators. Even if Hardy refers on reflection and memory in quality of a drawing in literature we have not found any study that would solve relation HS in DAP: IQ in adult population. In our survey, we did not find out a relation to verbal or nonverbal element that was surveyed by LGT3 test. When speaking about total HS in LGT3 test, statistically important relation was find out only at one evaluator at the level $p = 0.044$. Not very persuasive findings were achieved in relation to memory subtest ISA-S. We have found significant relation only for evaluator 2: for drawing of the first figure $p =0.019$, of the second figure $p = 0.004$.

DAP: IQ produces score that is according to our findings more connected to nonverbal elements of intellect. When speaking about individual elements of intellectual abilities we did not find any important relation to any concrete subtest with the exception of memory test – it seems that memory could play some role. Stated facts would also be in harmony with starting position of Goodenaugh (1926) that person is drawing what he/she knows and not what he/she can see. The issue that we could currently see is the use of various scoring systems – some use DAM, some GHT, others DAP: QSS or DAP: IQ. It could be awaited contradictory findings especially when we realize that every further system had to be improvement of the preceding one: adaptation of scoring criteria, currency of standards. Rehring,Stromswold (2017) also point out to the need to evaluate not only reflection of intelligence in human figure drawing but also other skillfulness and abilities. Score distortions in DAP: IQ that could have an influence on relation of DAP: IQ and intelligence abilities could also result from some uncertainties and/or from insufficient way of evaluation (e.g. evaluation of nude figures that automatically lose points for clothes, while they could be elaborated in a high quality). Study has been done on a small sample and so conclusions have limited validity. This is why it is necessary more thorough verifying on a bigger number of probands also with emphasis to accept variables as sex, age categories, and education. Human figure drawing is "more simple" tool than other more complex tests but its screening potential when speaking about fluid intelligence and possibly memory abilities seem to be prospective. Assigning of test as well as its evaluation is sufficiently undemanding, evaluation categories sufficiently understandable.

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