



Computer Aided Analysis of Projective Tests

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Abstract—This paper is focused on the use of a computer aided method for analyzing the drawings of patients' undergoing projective psychological tests. The sketches are drawn on a standard A4 paper placed over a specially designed touch screen. The authors developed the software aimed to automatically both to automatically measure the geometrical characteristics of the designed object and to deliver some additional parameters (e.g. pen pressure, speed etc.) useful for the clinical study.

Index Terms—Image processing, projective tests.

I. GENERALITIES

PROJECTIVE tests are personality tests elaborated to let a subject respond to ambiguous stimuli, disclosing his hidden emotions and internal conflicts. During the psychological evaluations they are a useful alternative approach to Objective test (e.g. multiple choice quiz where patient's answers are evaluated according to a standard pattern). The results of the projective tests are content analyzed in order to detect their significance. Projective tests were developed and employed by psychoanalytic psychologist, taking into account the fact that humans have both conscious and unconscious attitudes and motivations which are frequently concealed from conscious awareness [1].

Many projective tests are based on the clinician's profound analysis of a given theme drawing executed by the patient with a simple pencil on a sheet of standard A4 paper. Usually an eraser is also accepted and the performed corrections have their own significance in the final evaluation. Such diagnostic techniques are called figure drawing and the test's subject is ordered to sketch an object, a person or situation, selected so as to make possible assessments over his/hers mental & emotional state.

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Results of all these projective tests must be regarded with caution, and their limitations should be always taking into account. Generally it is recommended to use projective tests as part of a global test battery [2].

Most popular and frequently used figure drawing methods are: Tree Drawing Test (TDT) and Kinetic Family Drawing (KFD). The final evaluation's criteria of the patient's drawing are quite different for each of these techniques; still there are some common aspects the authors of this paper take into consideration. Both projective techniques do share the fact that the psychologist must pay attention both to the global aspects of the drawings and to the details. Each evaluation must consider:

- Items aspect ratio;
- Items position in page;
- Items fitting into page;
- Speed of drawing;
- Pressure exercised on the pen while drawing

II. TREE DRAWING TEST

The Tree Drawing Test (also known as the "Baum test") is a projective testing method developed by the Swiss psychologist Charles Koch in 1952. It is widely employed in order to analyze the patient's personality and disclosure his/hers emotive history. Subjects are requested to represent a wide-leaved tree on a standard A4 blank sheet of paper in portrait orientation. The tree was elected as the item to be sketched because trees are non-threatening elements allowing a wide range of variations. Furthermore, trees are present as an important element in all significant mythologies around the world. Clinic experience proves that the kind of tree drawn by a patient relates to the structure of his or hers psyche. In recent years, the field of automatic interpretation of TDT has grown significantly [3], [4], [5].

There are two forms of TDT analysis used to evaluate and interpret the tree drawing:

- Global analysis - focuses on the tree as a whole. Its global size and location on the paper is considered. The ratio between the tree and the paper surface is important in subject's evaluation (e.g. large tree indicates a good level of self-confidence while small tree means the reverse state of mind). Some illustrative examples of these features are shown in Fig.1;

- Morphological analysis - emphasizes the finer details of the tree. Roots, trunk, branches, crown, leaves and others 54 features are described in the literature. These are measured & evaluated and ratios among them are computed. For example,

no branches or small branches tree reveals unsocial behavior while big branches tree is a sign of arrogance [6]. Most important tree characteristics are explained in Fig. 2.

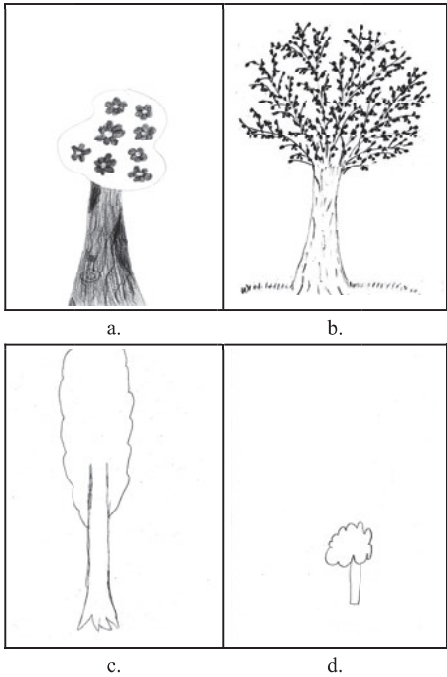


Fig. 1. Global analysis [6]: a) tree centered in page/graphic space (normal), b) oversized tree, c) tree excides the page/graphic space, d) small & off center tree.

Generally the analysis of the tree sketch is based on the computation of the following three quotients employed to quantify the test’s results:

- Ratio of trunk to crown;
- Ratio of left side to right side;
- Ratio of tree size to page space [7].

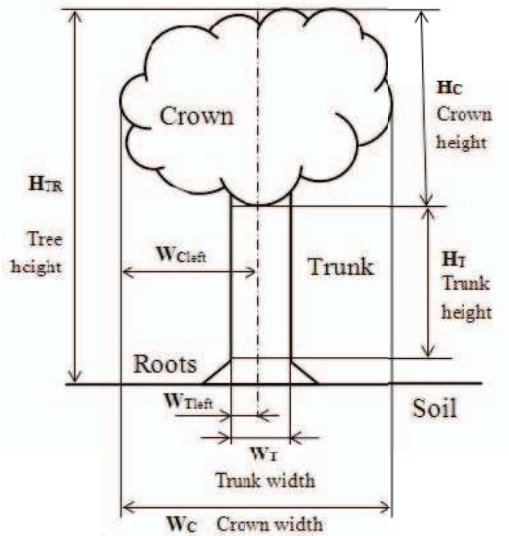


Fig. 2. Morphological analysis [8].

III. KINETIC FAMILY DRAWING TEST

The Kinetic Family Drawing Test was developed by Corman, Burns and Kaufman around 1970. The subject is required to draw a picture of his or her whole family. The family, including themselves, is depicted “doing some activity”. This sketch is meant to stimulate the child to express his attitudes toward his or her family and the overall family dynamics.

Mother Past	Passivity zone Life spectator space	Active life confrontation zone	Father Future
Introversion	Regression Primitive stage fixation	Impulsions Instincts Conflict	Extroversion

Fig. 3. Global analysis of KDT drawing.

The Griinwald and Koch show in their works that KFD, like Baum Test, have to consider both global aspects and the details. The position of the family members inside the graphic space shows the patient’s perception as illustrated in Fig. 4. [9], [10].

Regardless of their flexibility these tests require skilled and trained psychologists aware both with the theory and the structure of the tests themselves. Certain characteristics of the drawing are noted upon analysis, such as the placement of family members; the absence of any members; whether the figures are relatively consistent with reality or altered by the child; the absence of particular body parts; erasures; elevated figures etc.

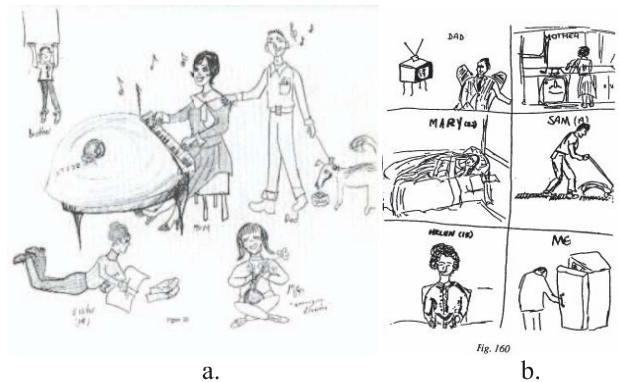


Fig. 4. Typical KFD drawings.

Clinical experience proves that a separation line or a big distance between the subject’s drawn figure and other family members is a proof of a conflict. Lines type is also significant; firm strokes signal a strong-minded person while reverse ones indicate a patient affected insecurity, timidity and lack of confidence.

IV. THE TOUCH SCREEN

Psychologists strongly believe that changing the “use the pencil to draw on this sheet of paper” paradigm is not allowed. Therefore replacing the A4 sheet of paper with a touch screen and the traditional pencil with an electronic stylus it will significantly affect the results of the test.

The authors of this paper do express their doubt about this, while young generations accustomed with electronic tablet PC and other similar technology which is now part their daily life. Still we had to respect the doctors’ opinion and consequently we employed a compromise solution acceptable for them. The standard paper is fixed over a special highly sensitive touch screen from Xantex Labs, thus the drawing is registered both on paper and in tablet’s memory.

The advantages of this new computer aided approach are:

- The patient’s drawing is available not only as an image but also as a dynamic progression of the intermediary steps of its making (a film of the drawing process). An example of a set of transitional states from white paper to final design is shown in Fig. 5;
- Gives additional information about the sketch (e.g. the drawing speed, the succession of representing elements into the graphical space etc.);

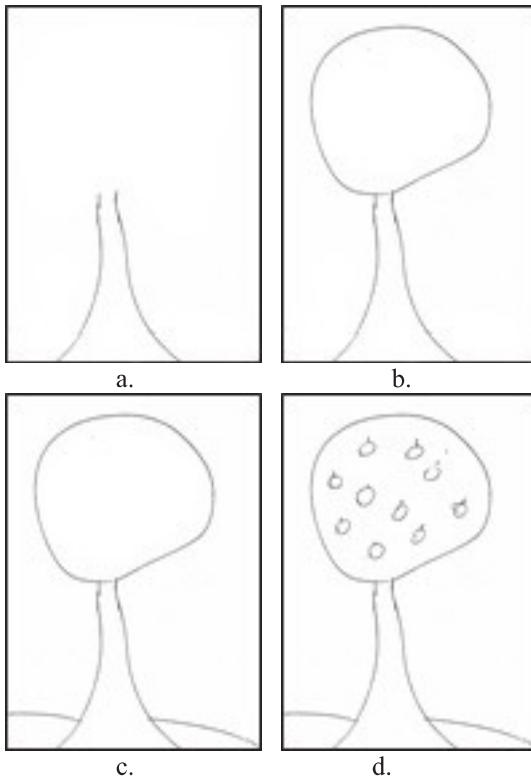


Fig. 5. The main successive steps of a TDT.

- Help the clinician to detect “timid” strokes, erased lines, trembling drawing, high pressure lines and other hidden features of the drawing. This kind of details can be easily emphasized if a color code is added in order to make them visible at first glance. An experimental result of such a pseudo-colored representation is given in Fig. 6. where strong lines are represented with red, weak ones are marked in blue and green means erased areas;

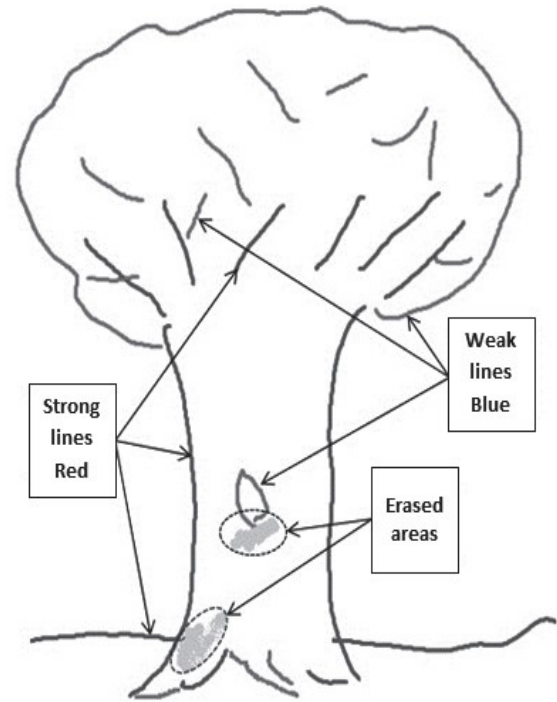


Fig. 6. Pseudo-colored representation of the patient’s sketch.

- Semi-automatic measurements of global features (e.g. Ratio of tree size to page space in TDT, Topographical distribution of characters in KDT etc.) and of significant details (Trunk width in TDT or Distance among characters in KDT etc.);
- Eliminates errors due to image scan and preprocessing, operations required for the drawing insertion into patient’s electronic folder;
- Creates the straightforward possibility to use TDT, KDT and other projective techniques in Telemedicine applications;
- Can be adapted and extended to other projective methods like: Draw a Person Test (DPT) House Tree Persons (HTP) etc.

V. EXPERIMENTAL RESULTS

The automatic analysis software was tested on a set of 109 real subjects’ Tree Drawing Tests from dr. Veronica Violeta Fejes psychological practice. It proved that usually the computer added evaluation is more accurate than the doctor’s one because its measurements were more precise. The correct classification ratio of the tree position inside the drawing space was 92.035%. The global success ratio in determining the tree size is 97.91% and the tree slant was correctly detected in 96.04%. Still, in this case, the distinction between right or left slope was only 88.14% and some additional improvements are needed. All results are shown in Table I.

TABLE I
CLASSIFICATION RATIO

	Psychological interpretation (%)	Automatically interpretation (%)
The position inside the drawing	91.83	92.035
The tree size	89.59	97.91
The tree slant	76.93	96.04
The distinction between right or left slope	98.30	88.14

VI. CONCLUDING REMARKS

Projective tests are a useful alternative approach to standard psychological examination tests. These tests require skilled and trained clinicians aware both with the theory and the practice of the tests in schools and hospitals. Literature and clinical experience shows that evaluation must take into consideration both global aspects of the drawing and its details. Therefore a significant amount of time and intellectual effort must be spent in order to perform each diagnosis.

Authors strongly believe that computer assistance to this very important work is welcomed and look for practical solutions to implement a technology able to help the psychologists without harming any of the results' credibility. This credibility was built in many years of work using standard methods and hence it became clear to us during our research that sudden changes are not welcomed.

Still using the above described technology we were able to start a research path which is promising to deliver a better alternative to the manual processing of projective tests' results helping doctors to work more efficient and precise and giving way to further progresses in automatic analyses of the drawings.

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