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Person's Temperament and Character Type Detection Based on Modern Information and Communication Technologies

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"The whole world is built on types, which move with characters."

Abstract

The popularity of e-learning systems is growing because of their effectiveness. It is necessary to adjust learning/training scenarios for every trainee, using advanced information and communication technologies (ICT) tools to achieve this. However, it is not often respected that people have different perceptions of information. A learning system should consider the temperament and character of an applicant/trainee. Since people with the same temperament have approximately the same ability to perceive and process information, as well as similar labour skills, the learning system must first determine the applicant's temperament and after that, based on this, determine how long it will take him to absorb a certain amount of information from the training course. Testing is used for recognition of the applicant's temperament. But traditional tests–questionnaires are long and the applicant can manipulate with answers. Apart from those, there are other types of tests: color tests, picture tests, figures tests, drawing tests, etc. The advantage of such tests is that they are based on the subconscious processes and thus, are more free from manipulations with answers, take far less time, and less depend on the mood swings. Moreover, according to S. Dellinger, the applicant's temperament type represents a fuzzy set, because a person has one dominant temperament and one secondary temperament, with relevantly different credibility levels. This means, that the determination of a person's temperament should be implemented in a fuzzy environment, not in a classical environment. For this reason, we want to implement the first part of the teaching system, using this paper. Particularly, we aimed to create a quick and free-from-manipulations test-program, which would allow, determine the type of applicant's temperament for e-learning individualization needs and determin the innate working skills. The specific fuzzy method is applied. The program was successfully tested on different people.

Keywords: e-learning, tests, working skills, test-program, e-learning requirements individualization

1. Introduction

All people are unique - with their characterisations (idiosyncrasies) and reactions to different circumstances. These differences are explained by the fact, that people have different mind and temperament types. It can be assumed, that a person's behaviour and mental activity reflect his temperament. Temperament is a cluster of visible character traits, such as: communication habits, behaviour patterns, and a set of mind attitudes, values and talents.

Therefore, it has always been of great interest to determine one's temperament and other personal characteristics with various special tests. These psychometric tests evaluate only one or several features (capability, talent).
Nowadays, online teaching, training and consulting are becoming more and more popular. This was achieved using successful ICT and electronic tools (ICTE).
The simple use of ICTE is no guarantee of online learning success (Lauberte & Ginters, 2008). It may be necessary to make significant changes in the learning process.

People have different perceptions of information and different types of temperament (Briggs, 2020). That is why, the learning process adapted according to the needs of each person will reduce the duration of online training and increase its quality.

Traditional psychometric tests usually take a long time to perform, are complicated, and are based on a person's view of himself. Thus, according to the person's mood swings, results can be different. Moreover, according to the person's mood condition and needs, there is a chance of manipulations with responses. The reason for this is that, the answers to questions of similar tests are mainly based on the processes taking place at the conscious level. Therefore, apart from traditional tests - questionnaires, there are other types of tests: drawing, colours, geometric figures, pictures, card games, numbers, script, handwriting analysis, drawing and other tests. The special advantage of such tests lies in the fact, that they are based on subconscious processes and therefore are exempt from manipulation, while they take significantly less time and are less dependent on mood. Our goal was to create a short, fast and non-manipulative test-program, by combining several types of tests, presenting and processing of subjective information using modern information technologies. This would allow us to determine the temperament and character type of the applicant for electronic learning specifications and other needs.

The development of Future Internet, Internet of Things, Service Oriented Architecture (SOA) and soft computing - Cloud computing promises new opportunities in simulation engineering (Ginters et.al., 2011). Ultimately, it will make it possible to communicate between different simulation models and the environment. Virtual and augmented reality offer new achievements for e-learning training processes (Cirulis & Ginters, 2011). It offers a high level of interaction and wide possibilities. To achieve better teaching/training results, it is necessary to adapt the training scenario to each student/trainee requirements. The training system should take into account, that people have different styles of perceiving information according to the temperament and character type. In addition, the only way to ensure equal learning conditions for different groups (including the disabled, refugees, etc.), without affecting the learning process, is individualization of online teaching process, which can be carried out by taking into account the temperament and character type of the student.

1.1. Typology of character and perception

The most common classification of temperament is also ancient. It was introduced by the Greek physicians Galen and Hippocrates, with four main temperament groups: sanguine, choleric, phlegmatic and melancholic. Nowadays there are much more classifications available, however, this ancient version remains indispensable. The most popular, among traditional, and scientifically confessed test for temperament and character assessment, is the Jung Typology test, based on the typology of Carl Jung and Isabel Myers-Briggs and the Keirsey Temperament sorter (Briggs, 2011). The Jung Typology test contains 72 questions, each with only one possible answer "yes" or "no."

As mentioned above, apart from traditional tests - questionnaires, there are other types of tests: drawing, colors, geometric figures, pictures, card game, numbers, script, handwriting analysis, drawing and other tests.

Each particular test, determining the compatibility with temperament types, has been created by psychologists long time ago. The problem arises, when we need to take several tests at once and determine the type of temperament by combining the results of a separate individual test. This is practically impossible using classical logic and mathematics, because here we are dealing with subjective information.

1.2. TemPerMod - An agent-based simulation model in character and perception prediction, disadvantages and advantages

Consider one of the most modern approaches to determin the applicant's temperament - this is an Agent-Based Model – TemPerMod, which can be used as an independent tool and as the e-learning system component. The good thing about agent-based simulation is that the agent can make decisions independently. It requires agents to be more active than passive (Lauberte et al., 2010). Agent-based modelling is becoming increasingly acceptable to many fields in the social sciences because it offers a natural way to describe and analyze people. It is possible to simulate and manage a larger number of important factors, which is difficult to do in practice using other simulation platforms (Macal & North, 2007). Research began at the Institute of Socio-Technical Systems Engineering in 2008 with work on a new e-learning technology that accounts for the temperament and character type of a student-trainee.

The agent-based simulation model TemPerMod was developed in the NetLogo environment, so it is free to use. The TemPerMod result was compared with the results of the Jung Typology test and the Soloman and Felder questionnaire. TemPerMod matches the Jung Typology test, which delineates phlegmatic people with 75% and melancholic people with 71% accuracy (Silins et.al., 2010), but the comparison does not match between sanguine and choleric groups. More and more social scientists are using agent-based simulation (Silins et.al., 2010, A), (Aizstrauts et.al., 2011), (Religa 2012), (White, 2006).

2. A new approach-setting a task

The purpose of this paper is to create a short, quick and manipulation-free test software system by combining several alternative types of tests, using modern fuzzy technologies for presentation and processing of subjective information. This allows us to determine the applicant's temperament and character type according to Kersey's classifier, to evaluate his skills and propensities for types of work and activity that give maximum results. The same can be used for e-learning or other needs.

The Kersey Temperament Classifier is a personality self-assessment questionnaire, that helps people understand themselves and others better. It was first introduced in a book called

"Please, Hear Me". It is one of the most widely used personality assessment methods in the world and its customers include major employers including Bank of America, Allstate, US Air Force, IBM, 7-Eleven, SAFECO, AT&T and Coca-Cola.

2.1. Temperament and character as factors influencing training

David Kersey expanded the ancient teachings of Hippocrates and Plato to temperaments. In his work, Kersey uses sixteen types of temperament consistent with the type of sixteen personality described by Myers Briggs:

Individuals, with an **Artisan (Craftsman)** temperament, are concrete and easy to adapt. In search of stimulation and virtuosity, they are interested in gaining influence. Their advantage is tactics. They are strong in finding injuries, agility, and handling various tools, instruments or equipment.
Two categories of artisan temperament are:

- **Operators**, or direct artisans. Their main intellectual operation is acceleration. Attentive craftsmen and expressive patrons are two types of operators.
- **Artists**, or informational artisans. Their main intellectual operation is improvisation. Attentive composers and express performers are two types of artists.

Individuals with a **Caring Temperament,** are specific and organized. In search of security and ownership, they are interested in a sense of responsibility and duty. Logic is their advantage. Their strengths are organization, checking, support, and promotion. Listed below are two categories of caring temperament.

- **Managers** are direct caregivers. Their main intellectual operation is regulation. Attentive inspectors and expressive supervisors are two types of managers.
- **Advocates** are information managers. Their main intellectual operation is support. Attentive advocates and expressive givers are two types of advocates.

Individuals with an **Idealistic** temperament, are abstract and condescending. In search of meaning, they are interested in personal growth and individualism. Diplomacy is their advantage. Their strengths are purity, individualism, uniqueness and inspiration.
Two categories of idealistic temperament are listed below:

- **Mentors,** are straightforward idealists. Their main intellectual operation is development. Attentive counsellors and expressive teachers are two types of mentors.
- **Lawyers,** are informational idealists. Their main intellectual operation is to act as a mediator. The attentive healer and the expressive fighter are two types of advocates.

Rational temperament individuals, are abstract and objective in nature. In the quest of mastery and confidence, they are interested in increasing their knowledge and competence. Their advantage is the strategy. They are strong in various types of studies such as: engineering, theory, coordination and conceptualization.
Two categories of rational temperament are:

- **Coordinators, or** direct rationalists. Their main intellectual operation is management. Attentive secretive leaders and expressive field marshals are two types of coordinators.
- **Engineers, or** informational rationalists. Their main intellectual operation is building. Mindful architects and expressive inventors are two types of engineers.

Expressive role options are **Promoters** (expressive operators), **Musicians** (expressive artists), **Leaders** (expressive administrators), **Providers** (expressive conservators), **Teachers** (expressive mentors), **Champions** (expressive advocates), F**ield marshals** (expressive coordinators), and **Inventors** (expressive engineers).

Mindful role options include **Artisans** (mindful operators), C**omposers** (mindful artists), **Inspectors** (mindful administrators), **Advocates** (mindful conservators), **Counsellors** (mindful mentors), **Healers** (mindful advocates), **Organizers** (mindful coordinators) and **Architects** (mindful engineers).

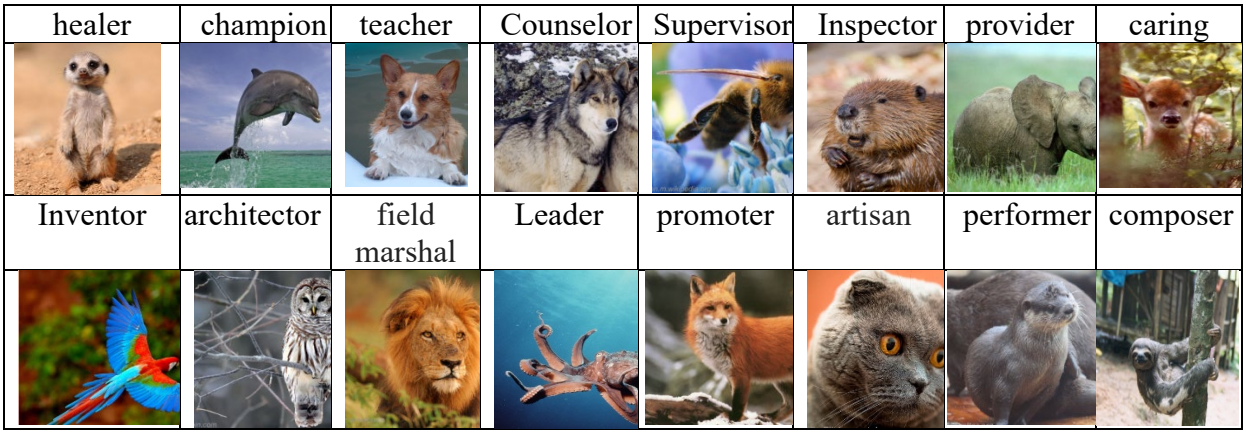
In the late 90s, Dr. Susan Dellinger coined the term "psychometrics" and explained not only how to determine your own character, but also how to use geometric psychology to determine the faith and attitudes of any person. She believed, that every shape, that has a specific outline: circle, square, triangle, rectangle, and wavy, expresses some character. She also believed, that these five characters exist in us, but we have one dominant character and one secondary one, which we use most of all the time. To say othervise, this is the concept of a fuzzy set, that a person's temperament should be defined in the form of a fuzzy set.

2.2. Selecting parameters for the model

The parameters chosen for our approach are:

1. *Figure 1: Characters of the animated film*

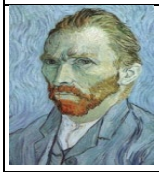
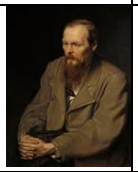
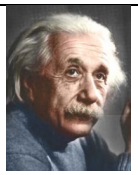
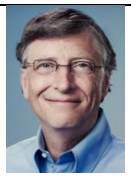
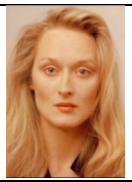
2. *Figure 2: Animals*



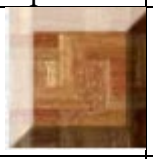
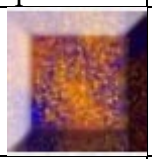
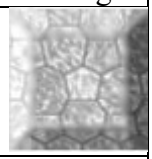
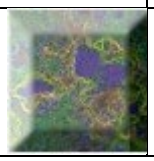
3. Facebook Activity – How to identify Kersi type by Facebook activity.

1) Leader
Posts life news every 3-5 days. Photos are uploaded very rarely, only in cases where Facebook does it automatically.
2) Field Marshal
He appears at many events and shows himself in all the pictures.
3) Inspector
He posts many photos expressing his frustration with humanity's behaviour.
4) promoter
He pretends to be drunk in many photos, which angers his friends.
5) craftsman
Invites friends to 'Candy Crush' several times a day, even though they never open the links
6) provider
He has been periodically uploading his wedding photos for several years.
7) supervisor
Profile Profile photo shows only his face.
8) Caregiver
Likes all statuses that have not caused a reaction from others in the last 10 minutes.
9) performer
Often sends invitations to strange parties.
10) composer
Takes a lot of selfies during the day.
11) healer
He chooses between posting funny photos of his friends and a post about human rights.
12) champion
Enthusiastically updates his marital status/location/career progress every 2-3 months and gets hundreds of likes.
13) teacher
Writes a lot of statuses with text that is likely to raise questions among friends.
14) Inventor
All posts can be argued without any reason.
15) Counselor
Often posts quotes from various famous people.
16) Architect
He hasn't posted anything in years, but he probably reads and follows almost everything.

4. *Figure 3: famous people*

healer	champion	teacher	Counselor	Supervisor	Inspector	provider	caring
							
Inventor	architector	field marshal	Leader	promoter	artisan	performer	composer
							

5. *Figure 4: ornaments*

healer	champion	teacher	Counselor	Supervisor	Inspector	provider	caring
							
Inventor	architector	field marshal	Leader	promoter	artisan	performer	composer
							

2.3. Fuzzification of parameters

When responding to the question, corresponding to these five parameters, the respondent first looks at all possible answers, and then marks one or more acceptable answers for each parameter in order. After marking, the value of the function of assigning the values (terms) of the linguistic variable corresponding to a specific parameter, is determined by the following formula: - (n-j+1)/n, where n is the number of answers chosen by the respondent for a specific parameter, n={1,2,3,…,16}. J is the sequence number of a particular choice (this is important!) for a particular parameter. Accordingly, when starting the system, a window appears first, Where it will be indicated that the order of choice is important, so, the first choice describes the value of the parameter, that corresponds to its nature most. This first choice should be dimmed, meaning it should no longer be selectable. The second choice should be between the rest of the values, that correspond to his nature most, etc. The question is based on both scientific psychological research and some interpretation. This ensures further determination of primary temperament according to Dellinger with the highest level of reliability and secondary temperament with a lower level of reliability.

2.4 Fuzzification of the output variable

As seen in S. Dellinger's work, the output variable is the set of one primary character (temperament) and one secondary character (temperament). Since in our case, the input variables are fuzzy variables, the output variable will be the fuzzy set defined on the above 16-temperamental set, that is, the output fuzzy set of temperaments can generally be represented as follows:

$$\mu_1 R_1, \mu_2 R_2$$

Where, μ_1 is the level of reliability of the primary character (temperament), and R_1 is the value of the primary character (temperament), and μ_2 is the level of reliability of the secondary character (temperament), therefore R_2 is the value of the secondary character (temperament). The task of the algorithm is, to determine the values of the primary and secondary characters (temperament) for a specific applicant from the list of 16 temperaments

listed above, as well as to calculate their soundness values, from the membership values of the input variables. The algorithm will use a pre-built knowledge base. Below is the full algorithm, followed by the corresponding knowledge base. In this algorithm, the correspondence of the output variable terms to the temperament types is as follows:

R_1 - Artisan

R_2 - Champion

R_3 - Composer

R_4 - Performer

R_5 - Inspector

R_6 - Supervisor

R_7 - Defender

R_8 - Supplier

R_9 –Adviser

R_{10} -Teacher

R_{11} - Healer

R_{12} - Fighter

R_{13} - Leader

R_{14} - Field Marshal

R_{15} - Architect

R_{16} - Inventor

To the extent, that the system has prior information about the correspondence of one or more answers to each question and the types of Keirsey's (knowledge base), each marked answer will be identified with the corresponding type when counting the results.

For the 5 characteristics we have chosen, 5 questions with their possible answers are presented. Since the results of all five questions are counted in the same way, let's consider one general view.

After entering the website, and starting the questionnaire, a question appears with 16 corresponding answers, where each answer uniquely meets the requirements of one of the 16 types, presented by David Kersey. After checking all possible answers, the applicant has the opportunity to mark one or more answers in the range [1,16]. Each marked answer (respectively type) as described above, will have a reliability function value:

$$(n - j + 1) / n$$

Where, n is the number of marked responses. Then, it is necessary to normalize the values of the accuracy functions, i.e. divide by the sum of the values obtained by this formula, from 5 for every individual question (parameter) separately. The reliability function for the rest of the answers, (types) will be equal to 0. It should be noted that, besides the answers to the individual question, marked by the aplicant, the system also remembers the order of answers. This will be necessary in case of equal reliability values, during defuzzification.

That is, after answering the self-question, we have a set of 16-element believability functions, where the believability value of each element is defined in the interval [0,1].

After completing all five questions, we will get 5 such sets. Finally, for each type of Kersey in this set of 5, we look for the maximum value and count how many times this type has been marked.

The final output variable will be a set of 16 elements, Where we get the maximum value for each type:

$$\mu_1 R_1, \mu_2 R_2, \mu_3 R_3, \mu_4 R_3, \mu_5 R_5, \mu_6 R_6, \mu_7 R_7, \mu_8 R_8, \mu_9 R_9, \mu_{10} R_{10}, \mu_{11} R_{11}, \mu_{12} R_{12}, \mu_{13} R_{13}, \mu_{14} R_{14}, \mu_{15} R_{15}, \mu_{16} R_{16}$$

Where, all μ's are numbers from 0 to 1 inclusive, and all R's are one of the 16 temperaments types, defined initially. Then, with min-max operations and the maximum principle, one primary, and one secondary temperament types are obtained, in the following way: The 2 types, with the highest rate, will be respectively the primary, and secondary types of temperament, with corresponding believability levels (membership function values). If, it turns out, that any 2 types have the same indicator, we chose the one, that has been marked more times. If even this method did not reveal one type, then we select the option, the corresponding answers of which were first mentioned more times by the applicant. If after that the reliability levels were the same for the two types, then, we first choose the one, that was marked more times in the order of primary questions.

3. Software implementation of the system

The software code is executed in the programming language - Visual C# (.NET), therefore Microsoft Visual Studio 2015 (version 14.0) is used as the administrator (editor). The program communicates with the applicant (user) through the website. The website is created using ASP.NET Web Application (MVC) technology. The website is a questionnaire and is easy to understand for the user.

After pressing the "Finish" button, the program displays the last window on the screen, which shows the applicant his temperament types based on the summarized test results.

The last window provides the applicant with the verbal values of their respective primary and secondary temperament types and the believability function values. Also a brief description of the corresponding temperaments.

Note: The code is designed in such a way that the applicant allowed to specify multiple choices everywhere.

4. Conclusion

Human behaviour is a complex, constantly evolving phenomenon. Accordingly, it is difficult to describe it with mathematical equations. Psychologists concluded long ago, that the mechanism of temperamental decision, has a strong effect on the systematic performance of both, a particular person and a group of people. Since traditional tests are long, and irritating and the applicant can manipulate with answers, alternative approaches have been developed to determine the type of temperament and perception of a person. According to Dellinger, the applicant's temperament and character type defined on the set of Kersey's types, is not a regular, but a fuzzy set, which reflects the fact that a person (and therefore, his temperament and character type) is unique, not a simple phenomenon, and is complex, and multifaceted creation.

Prior to our work, there was a system that also defined a person's temperament in a fuzzy environment - this is an agent-based TemPerMod model approach, which is briefly discussed in Section 1.2 of this paper with its disadvantages and the relevant papers are listed in our reference list.

By combining several alternative types of tests, and using modern obscure technologies for submitting and processing subjective information, a short, fast to perform and manipulation free test-program was created. It allows us to determine the temperament of the applicant and the type of character as a blurred set. It should be noted that the program algorithm is original.

The program communicates with the applicant (user) in dialogue mode through dialog windows. The system is implemented as an Internet application, so it is available from anywhere at any time.

The program was also tested on different people, which showed that, unlike the existing so far agent-based TemPerMod model approach, the given software system reviels the temperament and character type of applicants with all sixteen types of temperament with equal success. In general, gives very interesting results about the working inclinations and skills invested in it. In this particular paper, the selection of parameters for the software system, and their fuzzification are performed, and the design of the guessing system is also determined. In the paper, the fuzzy algorithm construction and the software implementation of the guessing system in the form of an Internet application are performed.

The advantages of our approach are as follows:

- We transferred the task of determining a person's temperament to the fuzzy environment, which allows us to determine the temperament in the form of a fuzzy set, the need for which was indicated by S. Dellinger
- This approach is also adequate because it is already well-known that subjective information should be formalized and processed in a fuzzy environment.
- Practice has shown that our system determines all temperaments with equal success, that is, it is free from the shortcomings of the existing approach.
- It is a practical approach, through which it is clear how we can implement the individualization of e-learning in reality, which is the basis for ensuring equal opportunities for education for any gender group.

In general, this type of software system can widely be used in determininga person's skills and aptitudes, which determine his successful field of activity. Thus, it can be widely used in the correct selection of suitable candidates for a certain position. In our opinion, the use of this software system would be very effective for entrants to correctly determine their skills before submitting documents to a higher education institution so that they can make the right choice when choosing a future speciality.

It can also be used in the individualization of e-learning, which ultimately allows for a reduction in training time and a significant increase in efficiency. For this purpose, we have implemented the first part of the training system in this work. In particular, we have created a fast and manipulation-free test program that allows us to determine the type of temperament of the applicant for the needs of the individualization of e-learning. Based on this, we are now working on implementing the second part - determining in numbers (probably in fuzzy numbers) how long it will take him to learn a certain amount of information from the training course.

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