# Digitization of Everything, the world of 0s and 1s,

# emerging trends in psychological assessment

Dana Rad, PhD., Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Sciences, dana@xhouse.ro

Edgar Demeter, Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Sciences, eddemeter@yahoo.com

Sonia Ignat, PhD., Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Sciences, soniabudean@yahoo.com

Gavril Rad, MD, Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Sciences, radgavrilarad@gmail.com

**Abstract:** Digitalization refers to the integration of digital technologies into daily lifestyle by digitizing everything that allows for digitization. In this paper, digitalization means computerization of systems for better ease and accessibility. Defining a digital psychological assessment methodology focused on how to gain more data out of individuals' responses has always been of interest and attracting researchers in the field of emerging digital psychology who are actually willing to invest in developing such a user friendly technology is becoming nowadays more art than science. The digitization of respondents' ratings in psychological assessments has reached a turning point in data analytics, mainly due to the limitations of statistical modeling. Statistics is simply not enough to rationally convey all the information respondent's data reflect. In the following theoretical review, we are presenting two of the most probably used digitization techniques in psychological assessments' data analytics, Fuzzy Rating Scales and Response Surface Design.

**Keywords:** Digitization of Everything, Fuzzy Rating Scales, Response Surface Design, digital maturity, advanced analytics

## 1. Digitization of Everything

A word that is often referred to as digitization, an interrelated process that relates to the direct translation of analog data into digital parts in the 1s and 0s sequence, the binary language. This helps any knowledge to be quickly accessed, interpreted and distributed using a computer network. The Gartner Glossary (https://www.gartner.com/en/glossary) describes digitalization as the usage of modern technology to transform an operating paradigm to create new revenue and value generating opportunities; it is the method of transitioning to a digital organization. Gartner

Glossary also states, as per Wikipedia, that digitization is the method of switching analog information to digital. Digitizing improved the productivity of all processes; digitalization ensures the fact that companies are already leveraging technologies to communicate with customers and meet their individual concerns with accuracy. Digitalization has the biggest ability to transform the manner in which we live and work; meaning that a technology that is almost invisible helps us find anything we want, in a glance.

Digitalization alludes to the reconciliation of advanced innovations into regular daily existence by the digitization of everything that can be digitized. The selection of computerized innovations to change a plan of action, aiming to generate opportunities through the usage of fresh, cutting edge technologies by leveraging the complexities of the digital network and the massive flow of digital content. The strict significance of digitalization gives a clear picture of advancement and innovation subordinated world. Thus, in our conception, digitalization implies the computerization of frameworks for simplicity and openness.

Digitalization represents the incorporation of digital technology into daily routine. Digitalization also involves rendering digital all that can be digitized and turning details into accessible format (Croon Fors, A., 2013).

The strategy, practice, or procedure of changing over (normally simple) data into a computerized structure which is computer coherent. Digitizing data makes it progressively practical to file, promptly access, and further provide. A concept also called digitization, an interrelated phenomenon that applies to the direct translation of analog data into binary language, the digital bits in sequence of 1s and 0s. This enables all knowledge to be quickly accessed, interpreted, and shared utilizing a computer network (Jones, P., Holmes, D., 2011).

Digitalisation is the multitude of socio-technical phenomena and processes for the implementation and usage of digital technology in wider personal, organizational and social contexts (Rad, D., Dixon, D., Rad, G., 2019; Roman, A., Rad, D., Egerau, A., Dixon, D., Dughi, T., Kelemen, G., Balas, E., Rad, G., 2020; Kazan, H., 2020).

Technological transition is nothing new, but this phase of shift is happening quicker than ever. The possibility of instability is a transformational catalyst. Even although emerging innovations that challenge existing procedures, they can also generate opportunities unparalleled.

The journey to digitalization presents challenges. In the old days the speed of change is unthinkable at rates. Job habits shift, new capabilities are necessary for the workplace, organizational structures are flatter, front-line employees are entrusted with a lot of accountability, virtually everybody in the company is able to operate wherever / anywhere, and progressively, AI will guide almost all processes. Additionally, both safety and personal privacy are becoming highly complicated and essential facets of every work. Like other improvements implemented by utilities, the digital transition includes expertise in change management. Becoming a digital industry isn't a fixed target, rather digital maturity is the evolving ability to take advantage of the benefits of continuous change.

Giving non-human objects identity has far-reaching advantages for the 4th Industrial revolution. In industries such as aerospace and engineering, the fusion of the simulated and

physical environments now allows for data interpretation and device control to fend off problems before they even arise. It may also avoid downtime, create new prospects and use models to support prepare for the future. So it will be in the next digital psychological assessment generation.

The introduction of secure digital identities could also obsolete many existing authentication processes and save everybody billions of wasted hours per year, significantly enhancing privacy and safety.

Defining a digital psychological assessment methodology focused on how to gain more data out of individuals' responses has always been of interest and attracting researchers in the field of emerging digital psychology who are actually willing to invest in developing such a user friendly technology is becoming nowadays more art than science.

## 2. New opportunities for psychological assessment

### 2.1.Fuzzy Rating Scales

In psychometric studies, the fuzzy rating method has been introduced as an instrument which enables the capture and objective assessment of the diversity, subjectivity and imprecision inherent in responses to several online surveys. The shortage of inferential statistics for comprehensive study of such answers has been a major obstacle for years. In these regards, the information from fuzzy rating method-based responses can be explored and exploited appropriately. This fresh perspective aims to explicitly support some of the key statistical advantages of using Free-Response Fuzzy Rating Scale-based questionnaires instead of using Closed-Response model with Fuzzy Linguistic Representations (S. de la Rosa de Sáa, M. Á. Gil, G. González-Rodríguez, M. T. López and M. A. Lubiano, 2015).

In the literature the fuzzy numbers scale was used to calculate multiple ratings, perceptions, valuations, preferences and other. One of the most commonly used method is fuzzy rating, based on a free fuzzy numerical response system, and the fuzzy conversion, which refers to the transfer of linguistic, in general Likert-type labels to fuzzy numbers. The methodological analysis of the two measures took the following steps into consideration: Fuzzy responses were first voluntarily simulated; these responses were *Likertized* according to with a five-point metric and a logical criteria; all the five Likert categories was converted into a fuzzy. (de la Rosa de Sáa S., Gil M.Á., García M.T.L., Lubiano M.A., 2013).

In measuring factors such as perception of quality, performance or attitude that are inherently imprecise, the fuzzy rating scale has been adopted as a psychometric device that enables evaluators to offer scores that are versatile and accurate, but not numerical. Because of the absolute independence in assessing scores, the fuzzy rating scale combines the expertise associated with the visual analog system with the capacity of fuzzy linguistic variables to catch the inherent imprecision in assessing these features. Research explains such an approach by a real-life illustration and reveals that mathematical results can sometimes be very different from the results that can be taken either from Likert responses or from their fuzzy linguistic encryption. This discrepancy enables the use of the FRS in the context of statistical significance, similar to the use

of accurate real-evaluated data instead of grouping them together (Asunción, M., Sarade, L., de la Rosa, M., de Sáaab, M., Montenegroa, B., Sinovaa, M., Ángeles, G., 2016).

### 2.2.Response surface methodology

Response surface methodology (RSM) is often a compilation of mathematical and statistical procedures, supportive in matching the designs and analyzing major issues where quite a few independent variables control the dependent variable (Montgomery, 2003; Myers et al., 2009). Empirical mathematical modeling is equipped with the correlating parameters for whatever feature of output.

In statistical analysis, the RSM approach investigates the relationships between multiple explanatory variables and one or more dependent variables. In 1951, Box and Wilson implemented the methodology, using a second-degree polynomial model. RSM's base idea is to use a sequence of designed experiments to get optimum response. They admit that this model is just an approximation, still using it since it is simple to approximate and implement such a model, even though little is understood about the model.

Statistical methods such as RSM may be implemented by manipulating operating conditions to optimize the output of a particular effect. The association between process variables may be calculated through statistical techniques, as opposed to traditional methods (Asadi, N., Zilouei, H., 2017).

RSM uses statistical models and thus clinicians ought to be mindful that an approximation to reality is only the optimal statistical model. In reality, the values of both the equations and the parameter are undefined, and thus prone to confusion in addition to ignorance. In fact, an approximate equilibrium point does not need to be perfect, due to the errors of the calculations and of the model’s inadequacies.

Thus RSM helps to identify the best experimental design to identify the associations between variables. RSM creates an effective experimental design that incorporates all the independent variables and uses the experiment's data input to eventually create a series of equations that can provide conceptual meaning to a result. The outputs are acquired from a well-designed regression analysis, based on independent variables controlled values. Based on the new values of independent variables, the dependent variable can then be predicted. The underlying mechanism is usually not well understood in social network issues, and the experimenter will estimate the uncertain function g with the acceptable empirical model

$$y = f( k x , x ,..., x 1 2 ) + \varepsilon,$$ where ε is representing the system’s error.

The function f is usually a polynomial of the first or second order. This analytical model represents a response surface model.

The identification and fitting of an efficient response surface model from experimental data requires the use of the basics of statistical experimental design, regression modeling analysis, and techniques of optimization. Usually all these subjects are merged into RSM. The researcher might

even experience circumstances in which the complete model may not be sufficient. Variable extraction or model design methods may then be used to determine the appropriate subset of regressor to be used in a model of regression. It is suggested to use the optimization process of simulated annealing to look for the right subset of regressors. There may be one or more near-linear correlations across regressor variables within the model in some surface response experiments. Multicollinearity may have significant consequences on the model parameter predictions and on the final model's overall applicability. The RSM is also immensely useful as an automated method for model configuration and validation, particularly for modern large-scale social networking computational multi-agent systems, which are being heavily used in modeling and simulating complex social networks.

Response Surface Methodology (RSM) is a set of statistical and mathematical techniques that are useful for process development, optimization and improvement (Myers, R. H., Montgomery, D. H., 2002). RSM's most comprehensive implementations are in the particular circumstances when multiple input factors theoretically influence any of the systems' output calculation or efficiency characteristic. And the response is called output measure or quality feature. Often input variables are recognized as independent variables. The RSM area is designed by the experimental approach to explore the process space or independent variables, computational statistical analysis to establish an effective estimated relationship between yield and process variables, and methods of optimization to identify the values of the process variables that generate suitable response values.

Response surface methods (RSM) have the purpose of optimizing a process or system. RSM represents a way of investigating the effect of operating conditions (the factors) on the y response variable. As we model the unspecified response surface of y, taking into consideration some restrictions, we push our method as near as possible towards optimum. Initially we'll use factorial simulations while we're far from the goal. When we reach the optimum such factorials are substituted with better designs at the optimum which more accurately resemble conditions.

## 3. Conclusions and implications

Anything that applies to our own identity would be digitized and connected to the Internet. Governments have until now controlled the identification of communities by providing social security numbers, visas, ID papers, and birth and death certificates. And some of the largest Internet corporations, including Google and Facebook, earned much of the income by capturing, aggregating, processing and monetizing personal information.

It is because we are introducing smart electronic devices (IEDs) and internet connectivity to promote knowledge collection, storing, and sharing, enabling interoperability and collaboration between connected devices. And in terms of psychological assessment the input data to be collected for further analysis is represented by respondent’s answers, usually on Likert scales. In our opinion, tones of crucial information is lost along the way with single numeric ratings like: 1, 2, 3, 4, and 5. Intelligent ratings, like Fuzzy Rating Scales, offers high potential to both respondent in choosing interval rating rather than single digit rating and researchers in getting to analyze a

function type of response that cumulates massive additional digital information related to respondent preferences. So, in other words a function instead of a single digit is giving to both respondent and researcher.

The resulting technical knowledge not only increases in-system control, detection, and stability, but also for the attached grid. Each additional digital interface installed in the substation or on the grid raises awareness of the situation and the ability to maximize network output utilizing analytics to analyze, view and transmit useful information or act on it.

The mobile behind the digital transformation movement may seem obvious, but to gain specific operational improvements, it's more than implementing discreet technologies. Developing a large variety of properties relevant to emerging technologies has a cumulative impact on the practical capacity of a further research's functional potential. Getting the opportunity to leverage data and technologies to continually improve certain facets of an appraisal method will greatly increase what it provides and produces, as well as the performance, expense and, perhaps most critically, how it communicates with individuals.

Online methodologies of appraisal have the benefit of representing multiple profiles while offering individualized support.

Many of the untapped potential of digitization, specifically for services, will be the capacity to evaluate the data of individuals from smart meters, and to generate personalized rates easily and at reduced expense, or to automate demand response systems. Once a psychological assessment becomes a digital assessment the list of possibilities continues. Digitization requires standardizing assessment procedures, which is related to cost savings and organizational excellence.

In the immediate future, researchers need to digitize all for broad scale testing of psychological tests, therefore the value of transparency in the digitization period is critical.

Digitization has major advantages: efficacy, organizational effectiveness, predictability. Digitization is an essential undertaking in psychological evaluation, for all the pain that it entails. Instruments cannot scale without digitization; they cannot absorb the complexity of the inputs of psychological information; they cannot personalize the services. Disciplined, systematic evaluation procedures render data available and accurate, maintaining the consistency and reliability.

Shedding habits, imposing discipline, has turned out to be more difficult than business leaders imagined. Leaders have in many cases committed to digitization initiatives thinking they are financing new and better technology. Many have yet to understand that digitization involves a dedication to profound improvements in how people function.

To become interactive, a creative new value statement will be expressed by the members. The value proposition has to reassess how emerging technology and knowledge will improve the current infrastructure and resources and generate added value. Leaders have to express a revolutionary new value proposition to become digital. This value proposition needs to re-evaluate how digital technologies and information can enhance the existing assets and capabilities of an organization to create new value.

And lastly, how to validate instruments al a global scale, if you don't use advanced digital forms of collecting responses. Researchers have focused excessively on statistical procedure to better ensure the data reliability, but still use old Likert scale to gain new information. In our opinion, in order to get more data insights from people responding digitally all over the world, you have to offer them a more complex tool, like Fuzzy Rating Scales for recording personal data.

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