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EXPLORING SUBJECTIVITY, OBJECTIVITY, TRUTH AND REALITY IN THE CONTEXT OF FORENSIC DOCUMENT EXAMINATION—REVIEW AND COMMENTARY

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ABSTRACT

'Objectivity' is undoubtedly the essence of all scientific inquiries and reports because it is often considered to be an attribute that imparts added confidence among various stakeholders about their scientific validity, accuracy and acceptability. However, it is also a scientific reality and bitter truth that 'Subjectivity', which is often considered by most of the people as its natural opposite, cannot be completely eliminated due to the presence of undesirable or debatable 'human' element in various stages of decision making. Since there is no sharp boundary-line existing between them, the usual gray area between subjectivity and objectivity is often exploited by many; while evaluating and interpreting the scientific reports, especially those issued by the forensic examiners.

The authors have, therefore, undertaken in-depth review covering various aspects of subjectivity & objectivity, as viewed by several researchers in their respective fields of study including forensic science; as well as examine its impact on the forensic reports. The purpose of this review is to bring home the point that 'subjectivity and objectivity' are ambivalent and complimentary, rather than being contrary; and both these attributes are imperative in any scientific inquiry to come closer to truth and reality and, consequently, for a better understanding of the world around us.

Keywords: Forensic Science, Forensic Document Examination, Handwriting Identification, Subjectivity, Objectivity, Truth, Reality, etc.

Introduction

Forensic Document examination (FDE) is one of the oldest disciplines of forensic science catering to the needs of investigating agencies to provide scientific aids for investigation of white collar crimes including handwriting identification and forgery related issues. The emergence of well researched book 'Questioned Documents' by Albert Osborn [39], as early as 1910, established the laws and scientific principles of questioned document examination on a firm footing, providing the much needed scientific support to the centuries old profession. While introducing Osborn's aforesaid book (38, 39), Wigmore (1910) expressed a sense of pride and satisfaction, when he wrote:

"A Science and an Art have developed. A firm place has now been made for the expert witness who is

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emphatically scientific and not merely empiric". He went on to state: "If there is, in truth, a science (and not merely an individual empiricism), that science must be based on reasons, and these reasons must be capable of being stated and appreciated".

Kirk, PL [34] raised pertinent and searching questions about the credentials of 'criminalistics' discipline, as it existed at that time. Is it a science? ; Is it a perfect science? ; Is it a profession? If it's a science in its own realm then, where are the principles, which should form the foundation for any pursuit, which is claimed to be a science? Towards Handwriting examination issue, Kirk rightly stated that among all the identifications, the identification of handwriting and detection of forgery is one of the most difficult jobs at hand. Joshi and Dey [32] perhaps reminded the people associated with the profession of questioned document examination of the Osborn's hundred year old message, by stating:

"Believe what you know, believe only what you see, believe what you understand and conclude after correct observation, skilful comparison, rational interpretation and logical reasoning of data obtained objectively. An examiner's aim should be to believe what he knows to be solidly supported by correct arguments and statements from the true principles without appeal to prejudice, special interest, subjective bias, ignorance, from blindness and emotion".

The same authors further stated that modern science in general is reasonable in its reliance on experience and logical argument; however, specialized science like the science of questioned documents, in addition to established scientific principles and procedures, uses unexamined ideas, problems and assumptions that often invite philosophical and scientific analysis and criticism Every questioned document problem is a research problem in itself and requires academic, pragmatic and forensic studies together with philosophical analysis. In fact, the opinion of the questioned document examiner is his or her well reasoned conclusion, which is objectively formed on the basis of analysis, collation and evaluation of observed data and not merely a personal judgment, subjectively formed.

Hilton [25] stated that writing identification involves the discovery and study of all identifying characteristics; the differentiation between those that are typical and those which are abnormal or represent the unusual. He further added that it is actually a pure forensic science in that it developed within the legal system rather than being derived from other professions such as medicine or chemistry. Harrison [23] was perhaps forthright in his admission when he wrote:

"As a measure of judgment is called for, it follows that the comparison of handwriting must be, in part, a subjective process and, consequently, liable to human error. As in any scientific process, there is an invariable tendency to shrink from conclusions which are not entirely objective; it is hardly surprising that efforts have been made to reduce, if not to entirely eliminate, the subjectivity element in the comparison of handwriting".

With more and more reliance being placed on the opinions of the questioned document examiners the world over, the challenges to this discipline of science as well as the practicing scientists, both from the bar and the bench continued to mount, culminating into the issue of Daubert's Standards, in the year 1993; which necessitated proving the credentials of the science as well as the expert witness, before the court testimony. The scientific credentials of this profession still continue to be undermined by many, labeling the handwriting expert opinions as purely subjective findings of the examiner concerned, rather than objective reports of their laboratory.

As stated by Joshi and Dey [32], the unending and resonating discussion on the issue of subjectivity--objectivity in various domains of science including forensic document examination appears to be subjective in it. They revealed their scientific temper and philosophical thoughts by stating:

"What makes a questioned document problem scientific and philosophical is not so much its subjective matter but the spirit in which it is presented and the objectivity of the method (approach) used in seeking the solution of evidence to establish the truth.....Therefore, proper conscience, and taking the things as they are , gives truthfulness; feeding the mind with the right knowledge and data, review of performance and knowledge of limitations of the profession increases competence; observing scientifically, seeing truthfully and saying truthfully makes it honest and; finally, concentration on the problem and contemplating and concentrating on the document will enable an examiner to see the facts through the mind and will lead him to a correct and logical conclusion, that will minimize the possibility of error"

Presumably, Daubert's Standards also expected all stake holders, especially the forensic scientists, to abide by and follow the above lines in letter and spirit. Gelman and Hennig [19] were apparently correct and relevant, when they stated:

"Concepts of objectivity and subjectivity are often used to justify, criticize, avoid, or hide the decisions that are made in data analysis. Typically, the underlying idea is that science should be objective, understood as something like 'independence of personal biases', without referring to any clear definition".

As there were differing views and perspectives on the same subject, which were interpreted differently by different people to their advantage, the authors considered it necessary to undertake a thought provoking review and study this important aspect affecting the validity of forensic science; and address the 'subjectivity-objectivity' concerns of various stakeholders along with their relevancy in the context of forensic document examination; so as to make the reports look more scientific, objective and useful to the society.

Brief overview of Subjectivity and Objectivity

As per the dictionary meaning, the word 'Objective' refers to findings that are not influenced by personal feelings, interpretations, or prejudice; are unbiased, based on facts to qualify to be an objective opinion; whereas, the word 'Subjective' refers to what is existing in the mind, belonging to the thinking subject, rather than to the object of thought.

Webster dictionary describes the word 'Subjective' as something arising or originating in the mind itself, not produced from something external but one's own mind; and the word 'Objective' as relating to or concerned with external material object, having an independent existence in itself and not existing merely in an individual's mind. Further, 'Objective' also refers to reports that does not reveal the author's personal emotions, opinions, or judgments; whereas, the word 'Subjective' reveals the author's judgments, biases and feelings.

It hardly needs emphasis that both the aspects of analysis, i.e., qualitative and quantitative, are essential to be considered for a complete forensic examination of samples to obtain correct and meaningful results there-from. According to Ratner [42], in qualitative methodology, the subjectivity of the individual researcher is reflected in scientific research starting from the choice of topic, followed by formulation of hypotheses, selection of methodologies, and interpretation of data. The role of the qualitative researcher involves an active participation in the research process by the involuntary subjective, element, which is followed by an experimental method, based on the assumption of objectivity, to support the earlier subjective view.

He has further stated that many qualitative researchers are aware of the distinction between subjectivity and objectivity; wherein objectivity is said to nullify subjectivity by rendering the observer to be a passive beneficiary of external information from the concerned agency; and the researcher's subjectivity is said to offset the possibility of acquiring objective knowledge of a social or psychological world. Therefore, it follows that true objectivity is almost impossible to achieve in any qualitative inquiry; because the subjective component of the researcher undeniably plays an important part in the research process.

It cannot be denied that quantitative analysis is often considered to be superior and more objective than the qualitative analysis, because it brings into process some statistical and numerical data based on measurement of various parameters being studied and evaluated. However, scientifically speaking, both are considered essential for complete analysis, leading to the desired results.

It is also a common knowledge that the information based on measurement of participant responses towards any situation (i.e., each person using an objective measure correctly, obtaining the same result) is referred to as objective; whereas that information, which is based on opinion and largely based on self reports given by the participants, and that cannot be verified by the researcher, are called subjective.

It is worth consideration and appreciation that subjectivity refers to a person's own views drawn from one's habits, inner feelings and prejudices, emphasizing on things as they relate to the self. It also refers to the belief that things exist because they are experienced by the concerned individual as such. It follows that to be subjective, is to be personal, emotional, interpreting the facts; speculating and imagining, concentrating on what one thinks and feels. On the contrary, objectivity refers to 'reality' that is external to the self facts which are 'real' and the same for everyone, observation uncolored

by feelings, bias and emotion. It also refers to the belief that things could exist separately from human knowledge and experience. Consequently, it follows that to be objective is to be impersonal, unemotional, factual, not speculating or imagining- just dealing with the 'facts'.

It is also important to be aware that both subjectivity and objectivity are to be seen in the context of reality; an 'objective reality' means that something is actual that exists independent of one's mind; 'subjective reality', on the other hand, means that something is actual depending on one's mind.

Obviously, discovery of truth and reality are the ultimate aims of all scientific pursuits, and in this search for truth, positive attitude and frame of mind of the person concerned matters a lot; and it may lead one to say that human being is, undoubtedly a reflection of his own mind which controls and governs his imagination and thought process. It also needs to be appreciated that there's subtle difference in meaning of the words 'truth' and 'reality', though both are the considered virtues and used in the same sense. Apparently, everything that happens is reality; but, everything that happens need not be truth. Further, it is often said that it is a harsh reality that truth is bitter to digest.

Practically speaking, subjectivity and objectivity are also to be seen in the context of their relativity, i.e., relative to differences in perception and consideration. A proposition is considered to have an objective truth, when its truth conditions are met without bias caused by a sentient (sentimental) subject. Further, as described by the oxford dictionary, relativism is a concept, according to which there is no universal objective truth; rather each point of view has its own truth- the belief that knowledge, truth and morality exist in relation to sociological and historical context, and as such are not absolute.

It is worth consideration that scientific objectivity refers to the ability of a person to judge something with neutrality, i.e., without partiality or external influence. Further, its twin types -- objectivity towards oneself (i.e., internal) and objectivity towards others (i.e., external) add to its significance or value.

Phillips [41] quoted from Myrdal, G (1969), stating that the spirit of social science is the search for "objective" truth; the belief of the student is his conviction that truth is wholesome and that illusions are damaging, especially opportunistic ones. He seeks "realism", a term which in one of its meanings denotes an "objective" view of reality……. How can then a biased view be avoided? After an interesting discussion on the hidden sources of bias and opportunism in belief, Myrdal also suggests some techniques to help achieve some degree of objectivity.

As reported by Phillips [41], Eisner, E (1986) objected to a commonly held belief that any research method which is acceptable to the scientific community could be stated to be 'objective' or value free to the extent that it does not reflect any particular view-point, because all methods and usual forms of representation are only partial. Traditional notion of objectivity is naïve (too simple to be realistic). The very notion of there being some doubt or any source of error in the process negates the idea of an objective truth which may be beyond our reach. It, therefore, follows that arguments about what is really 'real' are meaningless.

Interestingly, Ratner [42] reported that objectivism integrates subjectivity and objectivity because it asserts that objective knowledge requires subjective attributes like perception, analytical and synthetic reasoning, logical deduction, and the differentiation of essences from manifestations;conversely, subjective processes can enhance objective understanding of the world. Consequently, the aforesaid view of the author substantially modified the commonly held belief and narrative that subjectivity and objectivity were the traditional opponents.

According to Hari [21], the word 'subjective' is synonymous with 'non-material'. Since one's thoughts or experiences cannot be seen, heard etc., by oneself or by others, nor can they be accessed by any material instruments, all real information--the content of a conscious experience, is subjective. All conscious states, i.e., those states of awareness, sentience or feeling when we are awake, are subjective. Dreams, some of which we remember are also subjective. The same author has also described objectivity by proposing that, whatever that exists and is not 'subjective', is 'objective'. Hence, all matter and material processes are objective.

As referred by Hari [21], Searle (2000) described subjectivity by stating that conscious states are subjective in the sense that they have first person ontology (mode of existence) because their presence needs to be seen or experienced by some living being. Further, as reported by Hari [21], the concepts of objectivity and subjectivity are related to matter and information. Matter and Mind could be differentiated

because the former responds to senses while the latter does not. One's thoughts or experiences cannot be seen, heard etc., by oneself or by others, nor can they be accessed by any material instruments: one's thoughts are not known to others unless they are conveyed verbally or by any other physical means. If we refer all our conscious experience (within one's mind) as information, we may infer that matter is accessible to human senses, whereas the information (mind) is not. This inaccessibility to senses leads us to imply that our experiences are all subjective.

Hari [21] also interestingly linked the concept of subjectivity & objectivity with the quantum system when he stated that quantum mechanics (QM) appears to blur (or smear) the distinction between subjectivity and objectivity by proposing that a quantum particle (QP) is a packet of De Broglie phase waves, each of which is unphysical. He has further added that quantum matter and, hence, all matter could be said to comprise of objective information, because some properties of a quantum system could appear to be measurable in a suitably designed experiment, although the quantum itself is not directly observable as such. The said analogy adds scientific flavor to the concept of subjectivity-objectivity, which was by and large considered to be sociological and psychological phenomenon by many.

As referred by Phillips [41], Kerlinger (1973) perhaps emphasized on the importance of statistical data when he stated that objective methods of observation are those in which anyone, following the prescribed rules, will assign the same numerals to objects and sets of objects as anyone else. He has further stated that an objective procedure is one in which agreement among observers is at a maximum, and disagreements or observer variance is at a minimum; which means that, in a truly objective procedure, the variance due to differences in judges' assignment of numerals to objects should be 'zero'. However,in actual practice, this appears to be a rare possibility. Kerlinger (1973), therefore, rightly acknowledges that all methods of observation are inferential; but infers that procedures which assign numbers are comparatively 'more objective' than others.

Credentials of Forensic Document Examination

The art and science of Questioned Document Examination finds its origin more than five hundred years ago in one form or the other. It is as old as the history of writing and writing materials. Significant contributions were made by various experts like Daniel Ames (1901), Albert S Osborn (1910, 1928), Ordway Hilton (1956, 1982), Wilson R Harrison (1958, 1966), James VP Conway (1959), Donald Doud (1916-2005), David Ellen (1989, 2006), Huber & Headrick (1999), Morris (2000), Kelly & Lindblom (2006), Koppenhaver (2007) Lewis (2014), Allen (2016), Harralson & Miller (2018), etc., who were renowned document examiners and authors of several text books on the subject. The book 'Questioned Documents' by Albert Osborn (1910, 1928) truly laid the foundation of this discipline and provided the much needed scientific support to this field of study.

As reported by Lewis [35], the discipline also got benefitted from various questioned document organizations like the American Society of Questioned Document Examiners (ASQDE, 1942), American Academy of Forensic Sciences (AAFS, 1948 onwards), ASTM Committee E 30 on Forensic Sciences (1970 onwards), TWGDOC (1997), the Scientific Working Group for Forensic Document Examination (SWGDOC, 2013). Lewis [35] reported that research pertaining to questioned document examination appears in various Journals like the Journal of Criminal Law and Criminology, the Journal of Forensic Sciences, Science and Justice, Journal of the American Society of Questioned Document Examiners, the International Journal of Forensic Document Examiners, the Journal of Canadian Society of Forensic Science, Australian Journal of Forensic Science, the Forensic Science International, Egyptian Journal of Forensic Science, Turkish Journal of Forensic Science, Problems of Forensic Sciences, etc., recommendations of the National Academy of Sciences (2009), As further reported by Lewis [35], about one hundred publications on various aspects of FDE appeared during 2003-2013 decade in only two important forensic science journals, the Journal of Forensic Sciences and the Journal of American Society of Questioned Document Examiners.

The availability of various professional standards published by the ASTM and SWGDOC and stringent requirements of proficiency testing and quality assurance under the ISO has gone a long way to make the discipline more objective, scientific and professional. ASTM Guide E 2290 [3] standardized the extensive list of features that document examiners consider during the examination process.

The application and significance of statistical and mathematical methods in handwriting and signature examination along with the conventional methods

of examination have been reported in the literature. Evett and Totty [16] studied the variations in dimensions of genuine signatures and reported that such variations are statistically significant. Eldrige et al. [13] reported the use of 'Association Index' to describe the degree of association between different features of handwriting and made recommendations for forensic examiners based on the pattern of association observed between them, leading to the generation of quantitative information about the dependences which occur in cursive handwriting. Jindal et. al. [30] reported the use of metric analysis of handwriting for statistical evaluation of dimensions in several repeated handwritten signatures. Abbey [1] studied and reported the natural variation and relative height & proportion aspects of various letters in handwritten signatures. Even, Osborn [38] had stated that various parts of an ordinary signature, when carefully measured, bear a certain proportion to each other, which is surprisingly uniform.

Buquetand Manchon [4] reported that calculating the reduced deviation between two dissimilarity coefficients obtained from the comparison of documents' graphometric analysis gives the expert a greater degree of certainty in cases where prudence dictates caution. This experimental statistical method is a supplementary aid to the examiner in reaching his conclusion. Buquet and Manchon [5] further reported that calculating the probability of the same proportion occuring provides a statistical method which makes it possible to compare the findings in similarities and dissimilarities in two different expert's reports. With the help of this tool, an expert could make a quantitative comparison to find out whether or not the contents of the second report contradict the findings of an initial report.

Buquet and Manchon [6] also reported that application of 'variance analysis' to the graphometric characteristics of handwriting may provide the expert with confirmation of a qualitative judgment or an assessment based on the similarity / dissimilarity method of comparison.This method could be found useful in examination of Semitic scripts, which are more difficult to be compared, on the basis of individual letter forms,than the Latin scripts.

Found, B et al.. [18] were emphatic when they stated that, if the field of forensic handwriting examination is to be considered a scientific discipline, then the objective measurements of handwriting parameters must be carried out and included in the comparison process.They presented a computer program designed to compare the spatial elements of handwriting. Interestingly, they also described a technique, developed through research into human motor control, which has been modified to be used by forensic handwriting examiners for the comparison of disputed signatures.

Mohammed, LA [36] introduced a new tool- Write-On- through technical note in ASQDE for handwriting comparison based on software program. Similarly, Cedar-tech has come up with a software- Cedar Fox 1.4 version for computer based examination of signatures and handwritings. The application of such computer based tools will certainly enhance the level of objectivity in handwriting identification process.

Lewis [35] reported that the discipline of FDE successfully fulfilled all the five Daubert Factors as laid down by the United States Supreme Court in Daubert v. Merrel Dow Pharmaceuticals, 509 U.S. 579 (1993). These factors included the testing of theory, availability of standards, publication of research in peer reviewed literature, general acceptance in the particular discipline, and development of known error rate in handwriting comparison.

In view of the foregoing, it follows that the discipline of forensic document examination, including the handwriting identification and forgery detection has all the necessary pre-requisites, as in any other applied science; and its credentials are strong enough to be called a science per se, notwithstanding the unworthy comments made, time and again, by various people for whatsoever reasons.

Discussion

Most of the qualitative methods of comparison used in forensic sciences are, by and large, subjective. As we move from the qualitative (broader classification) to quantitative (closer individualization) analysis stage, the level of subjectivity of the method used for comparison goes on reducing/diminishing to the level of its becoming insignificant; and, consequently, the level of objectivity goes on increasing with emergence of more and more supporting data in the form of statistical and assigned numerical values to various parameters being compared.

Though objectivity is a considered virtue, it would be unfair and unwise to consider subjectivity as an evil, poor cousin or weakness as viewed by Daston and Galison [10]**.** Rather than being in opposition, both have virtues that are relevant in making decisions. Whereas, objectivity is considered to be a scientific

concept; subjectivity, which is largely based on philosophical or personal opinion, is often linked to an art or skill. However, it needs to be understood that both ultimately move towards their common goal of 'realistic truth', subject to time, place, and circumstances. The Daston and Galison [10] approach leads us to understand objectivity as a variable and adaptive idea taking us a step further to understanding of science and evaluating truth; its awareness alone has the potential of changing the science within thereby helping us to further grasp the true spirit of objectivity and, in the process, define ourselves more clearly and precisely. The word objective may be understood as a type of neutral omniscience, or unlimited knowledge which Thomas Nagel [37] truly described as the 'view from nowhere'. Most people see objectivity as an ideal that is methodologically strict & disciplined, subjectively untainted, and scientifically peer reviewed.

Osterburg [40] suggested that for transformation of evidence evaluation from a subjective to an objective process, three conditions should be fulfilled: first, the Criminalistics must be recognized as a separate philosophy and practice and not as a conglomeration of techniques; second, standardized methods of analysis will have to be developed for the examination of the common clue materials; and third, the statistics need to play an important role to introduce objectivity into the identification process. However, he has appropriately cautioned when he stated that the use of statistical evaluations of physical evidence cannot be rushed through and, therefore, sufficient time must be given to the forensic examiners to devise proper methods of analysis, implement the same in their routine work, and include the data in their reports to generate the necessary confidence level among the various stakeholders.

Refering to the importance of using measurements and statistical data, Dixon and Massey [11] stated that the theory of statistics,that is applicable to economics,could also be made applicable to any other field of study. Huber and Headrick [28] concurred with the aforesaid view of the authors when they stated that statistical proof underlies all scientific investigations, and the basic tool is the same across all disciplines.

The non availability of probability data in published material, perhaps, led Kirk [34] to show his genuine concern for existing weakness in the comparison process, when he commented that handwriting analysis, despite statements to the contrary, cannot be truly scientific until such serious omissions are appropriately addressed. However, Hilton [24]**,** while pointing out some of the difficulties in collection and classificationof the writing data that Kirk insisted upon, clarified that when the examiner arrived at the conclusion that the two sets of writing were written by one and the same person, he would have actually applied the theory of probability qualitatively, but without mathematical calculations.

Hilton [26] stated that, though personal (or individual), writing habits of a writer usually form the basis of handwriting identification; yet, in actual practice, only some of those habits are individual enough, or unique to that writer. Hence, there is merit in his suggestion that the forensic examiner needs to evaluate the personal habits thoroughly and, consequently, develop a unique combination of writing characteristics that are less common (and hence, more individual), which should form the basis for handwriting identification. While making such assessment, probably, the author was having, in his mind, the generation and evaluation of statistical data of handwriting characteristics, based on their frequencies of occurrence within the scope of that writer as well as in relation to several other writers.

Highlighting the importance of qualified opinions based on statistical probabilities, Huber and Headrick [28] explained that there is no other way to describe in precise terms what is meant by a strong probability or a very strong probability to an intelligent audience. Only mathematical numbers will indicate the relative certainties implied by the two expressions.

Huber [28] was very emphatic and rightly so when he stated that the only means that is available to us to convert observations and evaluations (or judgments such as conclusions) that are qualitative, subjective, and private, to forms that are quantitative, objective, and public, is by means of numerical values that are communicable. There is no alternative to numbers that is available to us to define precisely what we mean by probability, strong probability, very strong probability, or any similar expression, to indicate the respective levels of certainty that each expression represents.

In an interesting paper, Evett [15] condemned the negative attitude of some people who do not appear to be very scientific; and he was forthright and candid to state that, it ultimately depends on one's own state of mind to considerthe forensic science as a science, or not. Unbothered by such criticism, he seemed to remind the examiners that science is based

on observation, experiment and measurement; and any measurement is exact only up-to a certain limit; and, as such, the examiners must be aware of such limitations and uncertainty.

Thornton [47] cautiously reprimanded and provoked the forensic experts who have a natural tendency to reject statistics and probability in their forensic work for the simple reason that they generally don't understand them, and are admittedly ignorant, as to how they can be implemented in their routine work. He carefully urged and inspired them to understand that the process of mastering statistical models may be a slowand reluctant march through the enemy territory; but, as there's no escape, we must begin to plan for that campaign as early as possible.

The terrible hurry, anxiety and concerns of some forensic examiners to achieve objectivity and acquire the full scientific status was highlighted by Dror [12], when he stated that, in an attempt to be objective, forensic examiners are often put on a pedestal that undermines a lot of important and valuable forensic work, which they consider to be subjective and, hence, unworthy of making any significant contribution towards the final conclusion. He has, however, emphasized that, since there are two distinct aspects of their forensic work-- one relating to laboratory examination and the other relating to courtroom presentation, which are often intertwined; it needs to be understood that the ambition and drive to be an objective science are good to strive for—whether they are fully achievable or not, they undoubtedly advance and improve the domain.

Saviano [43] stated that the forensic examinations in which we are involved are based upon sound scientific principles, which in turn serve as safeguards against bias; and objectivity is understood as the foundation of any forensic examination, which is a goal to which a good examiner should aspire. Since, objectivity is the ultimate goal; our aim in any forensic examination should be, in a sense, to amplify the true and accurate characteristics and qualities of the object, while diminishing the aspects and influences of the subject. He has, however, raised a genuine concern—whether, at all, it is realistic to expect to attain complete objectivity?

Further, elaborating appropriately on the cause of subjectivity and factors responsible for its induction into the process, he went on to add that there can be no observation without the observer, no examination without the examiner, no analysis without the analyst, and no investigation without the investigator. All of these "subjects", of course, are human beings. Grieve, D [20] rightly pointed out that human beings are able to use their five senses to see, hear, smell, touch, or taste according to a most complex system of association, which is generally influenced by and based upon the individual's prior experience and understanding. These observations lend valuable support to the earlier views of Saviano [23]; and accordingly, there seems merit in his advice that we must accept and recognize our work to be both subjective as well as objective. Any reply to such question during the courtroom testimony should be suitably framed keeping the above facts in mind.

Saviano [43] went on to suggest further that the forensic examiners should concentrate more on what brought us to our conclusion, that is an examination of the evidence by a trained and experienced analyst, using accepted principles of analysis; and less on whether our analysis was purely objective (because, it was not so). He had rightly cautioned the examiners when he stated that; it is bias, rather than subjectivity that is truly the culprit in an unscientific analysis;and it is that self awareness of subjectivity, which will keep us on the path of objectivity. While we continually try to reach for that "pure" objectivity in our forensic examinations, we must always remain aware of our own subjective intrusion into the examination process and continue to devise and utilize those strategies that help us to avoid conclusions tainted by our own prejudices and biases.

Fisher [17] commented that scientists, commonly infer beliefs from their observations and experiments and sometimes they are very confident about them and sometimes less so. Hence, their confidence level, or moral certainty could be both subjective as well as objective. The said comments by Fisher are no doubt valuable and meaningful in the context of forensic science as well.

Butte College [7]**,** while discussing the "illusion of opposites" under the heading "Objective and Subjective Claims", wrote that since objectivity does not always guarantee truth, and since subjectivity may not necessarily be deceitful all the time, it follows that objectivity is not the exact opposite of subjectivity. It needs to be remembered that both these attributes are different modes of our knowledge acquisition process. If we start treating subjectivity and objectivity as the natural opposites,it will disturb the balance created by nature by way of their philosophical, moral, and ethical considerations.

The aforesaid views of the authors appear to be relevant and practical; and, as such, worthy of being considered appropriately while making decisions in professional scientific disciplines,like the forensic document examination.

While discussing the educational approach of subjectivity and objectivity, Constantina and Constantine [9] stated that Inter-subjectivity is the idea which premises peer reviewing and critical transformation as a means of allowing a number of subjects to agree upon a certain topic; inferring thereby that, science is, to a certain degree, objective not inspite of its sociality, but because of it.The aforesaid approach suggested by the authors certainly adds some value to the objectivity content of the subjectivity.

Chandrasekaran [8] stated that subjectivity and objectivity constitute an 'integrated whole'.Unbiased approach to the study of all human experiences may prove that theyare inter-dependent dimensions or elements of reality, though the mind sees them as separate and independent, or it views one as completely subordinate to the other. Each of us is capable of assuming different perspective, some objective and some subjective. He has stated that embracing dualities and reconciling them to arrive at an integral reality is one of the approaches of integral thinking. While stressing the need for their unification, he added that further evolution of mind is possible only if man accepts both objectivity and subjectivity as inter-dependent, and gives them the status of equality.

Singh, et al.. [44], while discussing the limitations and uncertainties of handwriting identification stated that there is a possibility of unintended bias on the part of the forensic examiner, and bias can lead to error. Admittedly, it is one of the few disciplines of forensic science that depends primarily on subjective analysis and evaluation of evidence. However, the authors categorically stated that most of the document examiners are aware of this situation and attempt to be as objective as possible, using sophisticated instruments, where they can. However, they emphasized that since the identification process is precariously subjective, complete objectivity is difficult to achieve.

Strach [45,46] emphasized the importance of including statistical support in forensic document examination, when he stated that by putting handwriting examination on a more statistical basis, both in terms of studies and classification of a large number of handwriting characteristics, and in assessing the reliability of document examiner's conclusions, hopefully, the handwriting comparison aspects of document examination will be put on a firm statistical and scientific basis. This will render as insignificant, the frequent criticism of expertise of the document examiners in the main area of their field of work.

Evett [14] suggested the synergistic combination of expert judgment and statistical data as his view for the future; wherein Bayesian inference could provide the logic, and the intelligent knowledge based system (IKBS) could provide the methodology. This is, certainly, need of the hour because different approaches and calculations based on calculus, geometry, and statistics could provide objectivity and logic to the overall approach of conventional and traditional methods of handwriting examination. The futuristic vision of scientists like Evett [14] had the potential to inspire more such research and devise some methodology based on mathematical models and artificial intelligence, which could be directly put to use by the forensic examiners in their routine work. However, despite lot of parallel work that is being done by the computer professionals so far, in this direction, it has not produced the desired results. Hopefully, the day is not far when the parallel research going on in the related fields of study will merge and produce the necessary methodology that could be used by the forensic professionals in their routine work involving handwriting identification.

Evett [14] further emphasized that a scientist cannot speculate about the truth of a proposition without considering at least one alternative proposition. Admittedly, any single proposition is incomplete and meaningless, unless the scientist has also considered and compared its results with respect to the other alternative propositions available to him. He went on to state further that the question of admitting numerical values as evidence, effectiveness of the procedures and recognizing the limitations and imbalances between the philosophy of technical and methodological progress and conventional philosophy of what is to be done or what has been done in the past lies in our attitude and state of mind, which undoubtedly can add to the objectivity of their findings.

It may not be out of place to state here that the practice of eliciting a second opinion (i.e., verification) is prevalent in the field of medical sciences too, just as

it is in the field of forensic science. The fact that there is an element of uncertainty or subjectivity existing in such an important and useful discipline of science, which is rightly considered as the lifeline by most of the people; must be seen as providing some respite and relief to the forensic examiners.

The observations made by Gelman and Hennig [19], in the context of statistics, that the words 'objective' and 'subjective' are often used by some of the people in negative sense to their advantage, seem relevant in our field of study also. Hence, there is merit in his suggestion that the word 'objectivity' should be replaced (or substituted) by well meaning attributes like 'transparency', 'consensus', 'impartiality' and 'correspondence to observable reality'. Likewise, the word 'subjectivity' can be substituted by similar user friendly attributes—'awareness of multiple perspectives' and 'context dependence'. In view of their broader scope, we can recognize the attributes of 'transparency' and 'multiple perspectives' as complementary goals, rather than the infamous opponents.

Summary

Objectivity and subjectivity, according to Daston and Galison [10], are as inseparable as concave and convex; one defines the other. In fact, one cannot be conceived or imagined without the other, without compromising their values. Essentially, all the original ideas that take birth in human mind, in the form of imagination and dreams are subjective, because they continue to reside within that subject's mind as one's personal property until they are brought on paper, communicated, verbally or otherwise; and carried forward to their next stage of hypothesis formulation, experimentation, verification, validation and results. When supplemented or supported by experimental data, and/ or other information, they tend to gain objectivity to the level of their acceptability by the scientific community.

The field of forensic document examination has an established system of examination due to its long history, scientific background, sound laws and principles governing various aspects of document examination, standardized and validated methods and techniques, standard operating procedures and practices and quality system that are fairly transparent, consensual, impartial & neutral, and corresponding to observable reality; that are equivalent to any objective inquiry.

Further, it needs to be emphasized that production ofnatural handwriting is a complicated neuromuscular controlled motor-activity which involves the synergistic coordination between human brain and the body muscles; the state of human mind (i.e., psychology) also playing an important part in that process. It is also dependent upon several internal factors involving neurology and psychology like perception, conception, execution;and external factors like varied nature of writing materials, substrate, etc. Therefore, it becomes imperative that all the scientific logic & tolerance limit must be exhausted before having any serious discussion on such a sensitive issue regarding its scientific nature, its subjectivity or objectivity. Any spontaneous or non-serious discussion must be avoided because it may, ultimately, lead one to believe that science and logic can be separated, which is undoubtedly far from truth.

It is heartening to note that the inherent element of subjectivity arising from awareness of multiple perspectives and context dependence does not, as such, interfere with the overall process of comparison. Since, the forensic examiner is well aware of their existence,he has learnt to balance its virtues as well as its side effects. Hence, it follows that both these approaches are complementary, rather than being contrary.A true scientist, therefore, does not see subjectivity and objectivity moving in opposite directions; but, on the contrary, sees them moving in the same direction offering him a window of opportunity to get closer to truth or reality.

However, consistent with suggestions of various authorities on the subject, the forensic examiners must respond positively and include the statistical data based on probabilities into their examination report so as to transform the evidence evaluation from subjective to an objective process, as early as they can. Last but not the least, it needs to be remembered that the ultimate aim of every scientific inquiry or investigation is to arrive at the truth or coming as close to truth as is humanly possible (i.e., beyond reasonable doubt). However, it must be kept in mind that objective reality, absolute truth, or gospel truth, (if any) is a theoretical concept. Angas [2] used a quote ascribed to the German philosopher, Arthur Schopenhauer, which appears to be relevant in the context of scientific research, and hence reproduced below:

"Every truth passes through three stages before it is recognized. In the first stage it is ridiculed,in the

second stage it is opposed, in the third stage it is regarded as self evident".

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