

Letters to the Editor

Calculation of Gustafson's 'Error of Estimation'

Sir:

There seems to have been a steady stream of papers (Bang and Ramm [1]; Johanson [2]; Maples and Rice [3]; Lucy and Pollard [4]) refining the procedures proposed in Gustafson [5] for age estimation using dental measurements. All criticize the statistical methods used by Gustafson and present what appear to be more rigorous approaches. However, one feature of Gustafson's original analysis has remained unexplained; that is the precise meaning of, what Gustafson calls 'error of estimation.' Here a derivation of Gustafson's 'error of estimation' is presented, thereby ending a 45-year-old mystery.

Precision in Regression Prediction

In 1950, Gustafson proposed a method of age estimation based on observed changes in teeth. Gustafson's method requires each tooth to be given a score of between 0 and 3 on each of six macrostructural changes. These six values are then summed to give a total points score.

Gustafson used a 'training set' of scores from individuals of known age and performed a regression of age, Y , on total score x , giving a fitted regression line of the form $\hat{y} = a + bx$.

Now, to assess precision one approach is to look at the standard deviation of the predicted age \hat{y}_0 corresponding to points score x_0 , this is given by

$$s_{\hat{y}_0} = s_{y|x} \sqrt{1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\sum(x_i - \bar{x})^2}}$$

where $s_{y|x}$ is the standard deviation of the regression given by

$$s_{y|x} = \sqrt{\frac{\sum(y_i - \hat{y}_i)^2}{n - 2}}$$

and n is the number of data points, \bar{x} is the mean of the total scores, y_i is the age of the i th individual with corresponding total score x_i and \hat{y}_i is the predicted age for a total score of x_i .

To summarize the precision as a single figure, the average prediction standard deviation of all observed total scores could be calculated. For Gustafson's data $s_{y|x} = 7.03$ (which is the figure quoted by Maples and Rice [3]) and the average prediction standard deviation is 7.2. Clearly, this is not the figure presented by Gustafson.

If we start by considering the prediction standard deviation for a future mean value (not a single future value),

$$s_{\hat{\mu}} = s_{y|x} \sqrt{\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\sum(x_i - \bar{x})^2}}$$

but then incorrectly use the sample standard deviation of the ages

$$s_y = \sqrt{\frac{\sum(y_i - \bar{y})^2}{n - 1}}$$

instead of the standard deviation of the regression, $s_{y|x}$. For Gustafson's data the sample standard deviation s_y is 16.96 this leads to a 'error of estimation' of 3.63, the same value as that given by Gustafson.

Acknowledgment

I thank Professor Mark Pollard and David Lucy (both Department of Archaeological Sciences, University of Bradford, UK) for making Gustafson's data available in computer readable form.

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Raped Women and HIV Infection

In the United States, the majority of sexual assaults involve females, and the incidence of rape victimization peaks in the 16 to 24-year-old age group [1,2]. The risk to acquire human immunodeficiency virus (HIV) at the time of a single sexual assault has been thought to be low. However, repetitive exposures, defloration, or the aggressor belonging to certain high-risk groups for HIV infection, would likely represent a different set of circumstances with increased risk. In the literature, about 25 cases of documented HIV infection of children ostensibly acquired through sexual abuse have been reported [reviewed in Bélec et al. [3]].

The need to consider the possibility of HIV transmission at the time of a sexual assault is now emphasized [1]. It is recommended to provide to the victim basic information about the risk of HIV infection, and, if the woman was tested for HIV at base line of exposure, to make follow-up serologic testing delayed for three to six months to allow time for seroconversion [1]. However, prophylaxis against HIV is not generally recommended [1].

We have recently reported the existence of HIV-seronegative women displaying anti-HIV antibodies in conjunction with prostatic components in their cervicovaginal secretions, that should

reflect passively transmitted anti-HIV antibodies during a recent sexual intercourse with an HIV-positive male partner [3,5]. Indeed, the seminal fluid of all HIV-infected men contains IgG antibodies to HIV, generally at high titers ranging from 1/400 to 1/40,000 [6]. Using various commercially available assays, including rapid tests, we further established *in vitro* that IgG antibodies to HIV within the seminal fluids from HIV-1-infected men can easily be detected when mixed with cervicovaginal secretions from HIV-seronegative women [5]. Therefore, we suggest that laboratory procedures needed in the evaluation of a rape victim could include a test for antibodies to HIV in the cervicovaginal washing, in association with documentation of recent coitus. Prevention of sexual HIV transmission should be initiated in an HIV-seronegative victim if the cervicovaginal secretions contain HIV-specific antibodies with motile sperm or seminal fluid secretions. For this purpose, systemic and genital prophylactic therapy should be proposed to the victim in the immediate post-exposure management. Then, zidovudine could be given *per os* as chemioprophylaxis, and a detergent spermicide active on HIV, such as nonoxynol-9, should be recommended at the cervicovaginal level. In the absence of HIV antibodies in vaginal washing, the assaulted woman should be reassured and counseled in an attempt to allay anxiety regarding potential risk for HIV infection.

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Further Commentary on Black Talon Bullet Recovery at Autopsy

Sir:

I read with interest the letter in the November 1994 issue [1] that addressed our previous letter on Black Talon bullets, and respectfully offer the following comments:

Our letter [2] was published not to "enter the fray," but to point out similarities between autopsy findings, ballistic gel experiments, and hunting observations in a Black Talon fatality, as well as to emphasize the hazards of handling the ammunition. Many civilian gunshot injuries are caused by relatively blunt, full metal jacketed rounds, and the jagged edge of the Black Talon may be unexpected.

I agree that X-ray pictures would be useful in identifying the round, and as well provide diagnostic information. However, visiting many laboratories and jurisdictions worldwide indicates they are not always available.

DuxSeal (or ordnance gel) experiments may not accurately reflect autopsy conditions; bone, fascial planes, obscured vision, blood, etc., can complicate actual missile recovery. Also many pathologists prefer not to probe wound tracks with instruments, with concerns about creating false tracks or damaging evidentiary markings on missiles [3]. Manual recovery with Armoured gloves may be preferable.

I would agree that the Black Talon round is a well engineered bullet, and that appropriate safety precautions should be taken. However, the Black Talon round is more dangerous to remove at autopsy, using standard techniques, than many other bullets [2,4].

The comments in this letter are the opinions of the author and do not necessarily reflect the views of any government agency.

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Commentary on "A Suicide by Self Decapitation," (J Forensic Sci, 38, (4), 981-984)

Sir:

I read the paper by Pritchard [1], in the Journal of Forensic Science, on *Suicide by Self Decapitation* with interest.

In the recently published 4th volume of *The Travels of Ibn Battuta (A.D. 1325-1354)* [2] there is a description of this being done the hard way:

"In this sultan's assembly I saw a man with a knife like a billhook. He laid it on his neck and spoke at length what I did not understand. Then he took the knife in both hands and cut his own throat. *His head fell to the ground because the knife was so sharp and his grip of it so strong.* The sultan said: "Does anyone do this among you?" I said: "I have never seen this done anywhere." He laughed and said: "These are our slaves and they kill themselves for love of us."

Acknowledgment

Acknowledgment to the Hakluyt Society for permission to print the passage from *The Travels of Ibn Battuta*, Vol IV Edited by C. F. Beckingham.

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Unintended Toxicity (Intoxication) by Cannabis Ingestion of Space Cake

Sir:

In The Netherlands, there is a liberal policy with regard to the use of cannabis (marijuana and hashish). The sale of marijuana and hashish is tolerated in so-called "coffeeshops." (Figs. 1, 2). The Dutch government and most town councils allow this if:

- no more than 30 grams per sort of cannabis product is available in the shop (some shops have even more than 40 different sorts of hashish and marijuana)
- the coffee shop does not advertise, does not distribute stickers, or carry out any other measures to encourage sales (only a cannabis leaf in the window is permitted)
- absolutely no other product that comes under the opium law is present or is offered
- no sales are made to persons under 16-18 years of age
- the persons living in the area and the neighborhood shops have no hindrance from the coffee shop

Officially, in the Netherlands, the possession of 30 grams of Cannabis can be punished by a fine of DFL 500 (\pm U.S. \$ 300) or one month in prison. This liberal policy, with detailed education of teenagers, has solved a great many problems. Recently, however, the weekend use of marijuana has clearly risen, possibly though increasing individual cultivation of cannabis plants by students. The unwitting consumption of "space cake" can pose a serious risk. During the last meeting of the Society of Forensic Toxicologists (Tampa (FL), November 1994) I noticed that most colleagues did not know the phenomenon of space cake.

Space Cake is prepared by mixing several grams of marijuana or hashish with melted butter (the amount can vary considerably) and stirring for a while on a low flame. During this period, the lipophilic tetrahydrocannabinol (THC) is extracted into the fat of the butter. The butter is then filtered. Cakes are then made using the usual recipe but with the THC-enriched butter. In many cases, the color and taste of the cannabis extract are masked with chocolate and a dark coloring agent. This space cake is offered for sale in coffee shops as well as other places. The name "space cake" has been chosen because of the so-called space expanding effect on the mind. It is also sometimes known as "peace cake."

The use of space cake by persons who have seldom or never used cannabis can have potent effects such as confusion, anxiety, the loss of logical thinking, fits of laughing, hallucinations, hypertension, and/or paranoid psychosis. This can be very frightening for inexperienced users because they do not know what they have eaten, what has happened to them, and how long the effects can last. The effects begin after 1 to 2 hours and can last as long as eight hours.



FIG. 1—Coffeeshop.



FIG. 2—Coffeeshop.

Illustrative Cases

Case 1

A high school class held a Christmas party at the home of a teacher. The students were all asked to bring cookies or chips. Three boys made space cake for the first time themselves at home using a friend's recipe. One of the parents knew that something was going on but didn't realize precisely what. At the party, the cake was distributed. All class members found the cake bad tasting and put the plate with the cake under their chairs. The remaining bits of cake were eaten by the dog. The teacher himself found it impolite with respect to the boys not to eat the cake and ate it more or less against his will, not knowing what was in the cake. Everyone went home at 11:00 p.m. Only the three boys who had made the cake sat in their chairs, as white as sheets and feeling strange. The teacher decided to bring them home. With the car

keys in his hand, he became unwell and fainted (if he had driven he could have caused a serious accident). The dog vomited the entire night. The boys were shocked. They had absolutely no idea of what they had done and of the consequences their actions could have had. The boys were required to clean the school yard for a week and were put on probation for expulsion from school.

Case 2

A patient in a middle sized hospital gave space cake to five nurses on the evening shift. The nurses had never heard of space cake and did not know what they were being offered. A while later they were walking around the ward completely "stoned" and were no longer in a condition in which they could carry out their nursing tasks in a reliable way. Another patient notified the police because a life-threatening situation had arisen on the ward because there was no longer adequately functioning nursing care. The patient who offered the nurses the cake was taken to the police station.

Case 3

On a routine urine check an American soldier in Germany was found to have used cannabis. Upon further investigation it was found that he had accepted a piece of space cake from a Dutch girl. The Dutch girl, in turn, had not realized that the (legal) consequences of eating a piece of THC cake for someone in the American army were far greater than those for someone in the Netherlands.

Case 4

A bus full of British tourists visited Amsterdam. At the end of the day they also wanted to visit a coffee shop and see how this sort of "hashish shop" looked from the inside. They ordered a safe cup of coffee or tea. The owner asked the tourists if they wanted to try "space cake," but pronounced it as "*spacial* cake." The British clients had understood him to say "*special* cake," and wanted it. They were shocked by the price of DFL 10 (\pm U.S. \$ 5.60) per piece. In the bus on the way to the boat to England, a number began to hallucinate, became anxious, wound up, or very still. When the bus stopped to allow someone to vomit, the passengers nearly walked over a very busy expressway. Only later did they make the connection with the "special cake."

The possible risks of the conscious use of cannabis are relatively low, especially when compared to those of alcohol or tobacco. The unknowing use of this type of substance, however, can have very serious consequences for the user and his environment. Good instruction is therefore required.

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Commentary on Pizzola, P. A., Roth, S., and De Forest, P. R., Blood Droplet Dynamics—I. (J Forensic Sci, 31, (1), 36–49, and on Ristenbatt, R. R. and Shaler, R. C., A Bloodstain Pattern Interpretation Case Involving an Apparent ‘Stomping.’ (J Forensic Sci, 40, (1), 139–145.

Sir:

There is an old expression, "No matter how many times you do something wrong, it doesn't make it right." And so it is when repeated references are made to an article that was published in the *Journal of Forensic Sciences* some years ago. I was aware of the errors in that article but at the time I did not want to bring them up for what could only be considered personal reasons.

Today, however, I can no longer ignore the errors in the original article as they have been quoted at least two times of which I am aware. This is likely to continue if someone does not point out that their source of information is incorrect. The article to which I refer is "Blood Droplet Dynamics—I" by Pizzola et al., [1]. I shall limit my correction to Pizzola's references only.

The problem is Pizzola's suggestion that Balthazard [2] used strings to estimate the origin of bloodspatter. This is incorrect. As the person who "discovered" the Balthazard article in Germany some 15 years ago, I am quite familiar with its contents. With reference to Balthazard's work Pizzola states, "They also explained how the approximate point of origin of a spatter producing impact could be determined and illustrated by the use of strings. Each string was carefully positioned to represent droplet paths deduced from the geometry of individual stains. They showed how both the azimuth and the elevation of the droplet path at contact with the surface could be learned from a study of the droplet stain geometry and how strings could be used to relate individual paths to the overall pattern." If Balthazard used strings in any way, he never mentioned it in the article cited.

The first publication I have found that cites the Pizzola error giving Balthazard credit for the "string method" is the laboratory manual, *Bloodstain Pattern Analysis* [3], by Bevel and Gardner. These authors are not at fault since they obtained their erroneous material from Pizzola. On page 2 they cite his publication as their source of information.

The second publication that cites Balthazard as the originator of the "string method" is an article by Ristenbatt and Shaler [4]. As a very prestigious journal with a wide circulation, I feel it is time to make corrections. With reference to Balthazard, on page 139 they state, "They also suggested the use of strings in conjunction with angle of incidence to determine the approximate point of origin of a blood droplet." This is not true, but it was not the fault of Ristenbatt and Shaler as they refer to Pizzola as their source of information.

As Historian for the International Association of Bloodstain Pattern Analysts I am continually searching for articles pertaining to this discipline. Thus far I have accumulated over 500 such references. The first document I have found that used strings to show the flight path of blood drops was Paul L. Kirk's report on his investigation of a bedroom in the Sam Sheppard home in Bay Village, Ohio in 1955. At the same time Dr. Harrison and I did similar studies at the State Crime Laboratory in Rhode Island.

Dr. Kirk's 1955 report [5] was never published and, therefore, remains almost unknown. It appears that the first publication to mention anything on the "string method" is a report I wrote 1970 for the Department of Justice. In "Flight Characteristics and Stain Patterns of Human Blood" [6] there are figures that show how I taped a ceiling with string to establish the origin of bloodspatter from a shooting within the bedroom of a 1969 homicide.

A second case described in my LEAA report was concerned with the origin of spatter. In 1966 I used strings and a protractor on the outside of a Volkswagen Microbus to accomplish this.

With regard to the Ristenbatt article in general, I would be remiss if I did not characterize it as unworthy of publication in

the *Journal of Forensic Sciences*. In my opinion their effort is only a report on a "ho-hum" case. Possibly, if they were to attend one of the meetings of the International Association of Bloodstain Pattern Analysts they might learn from those professionals who present much better examples of their case work. I shall resist the temptation to make comments on every error in their article but I think they would have to agree that the absorbency coefficient of a paper towel "head" is very much different than that of a human head. I can not agree with their conclusions. It is unfortunate that an experienced analyst did not read this paper prior to its unfortunate publication.

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Editor's Note: Contrary to the letter writer's assertion that the Case Report by Ristenbatt and Shaler, referenced above, was not read by an "experienced analyst," it was in fact reviewed by two experienced analysts in accord with the journal's general policies and practices.

Author's Response

Sir:

Frankly, we are disturbed by the letter sent to the *Journal of Forensic Sciences* and the latest International Association of Bloodstain Pattern Analysts (IABPA) newsletter [1] by Mr. MacDonell. Mostly, his is a criticism directed at Pizzola et al. for their work published in 1986 [2-4]. Evidently, Mr. MacDonell did not thoroughly read our Case Report before commenting [5]. He states that "it was not the fault of Ristenbatt and Shaler as they refer to Pizzola as their source of information." Contrary to what Mr. MacDonell thought, it is clear that we cited Balthazard et al. [6] for that information and not Pizzola et al. [2-4].

Our error (as well as Pizzola and his colleagues) is a matter of semantics. Indeed, Balthazard et al. discussed approximating the point of origin of a blood spatter pattern using the directionality and dimensionality of the individual stains [6]. For the benefit of those unfamiliar with this research, the following three diagrams taken from Balthazard et al. serve to illustrate our point (Figs. 14, 34, and 35 from Balthazard et al. [6]). The fact that they did not

use "strings" is inconsequential. Today, scientists and investigators use strings to visualize what Balthazard et al. described in 1939. Over 80% of Mr. MacDonell's two letters address this singular issue, a mistranslation from the Balthazard et al. work.

Mr. MacDonell suggests that we should attend one of the IABPA meetings to observe "professionals" presenting higher quality case reports. One of us (RRR) attended a meeting in Montréal, Canada in 1991 and was unimpressed with the quality of work presented. Mr. MacDonell agrees with Dr. Peter De Forest that "no amount of experience can supplant scientific knowledge and a thought

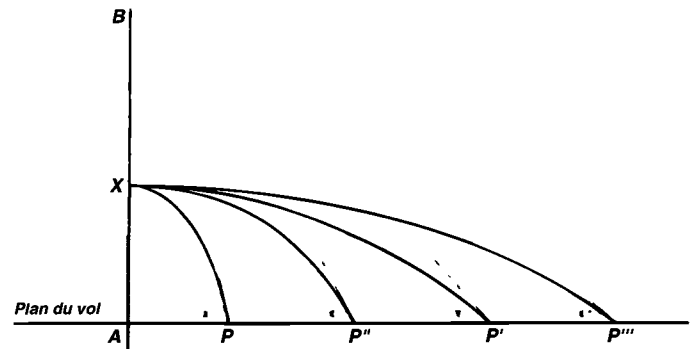


FIG. 14—Relationship of the width/length of stain to the angle of "arrival" of drop on a surface.

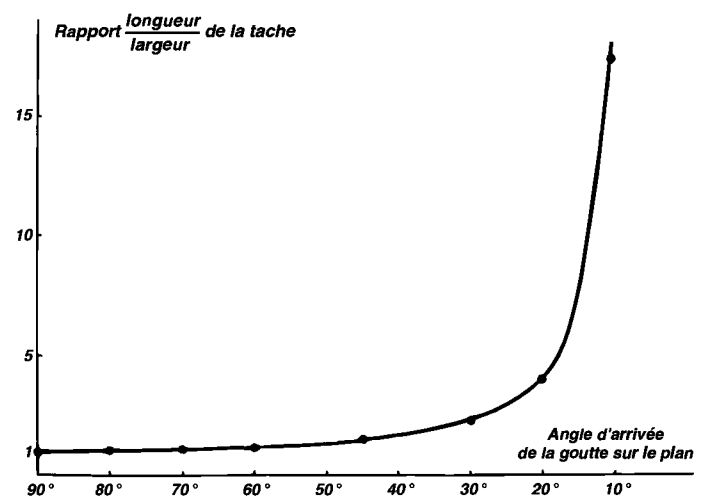


FIG. 34—The convergence of axes of stains found at P, P', P'', and P''' is determined by point A.

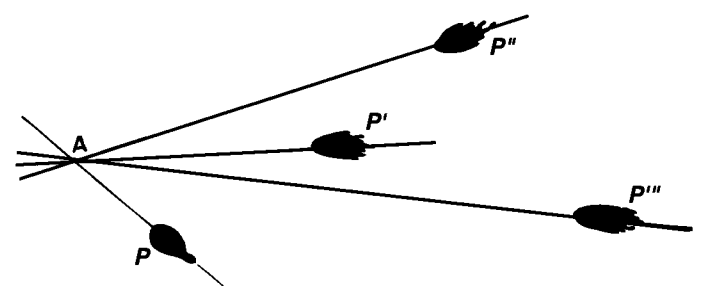


FIG. 35—The blood originated from point X situated on vertical elevated at point A. The form of stains at points P, P', and P'' allows us to understand the angles α , α' , and α'' (see arc in Fig. 14).

process based on careful adherence to the scientific method" [7,8]. Thus, we question a group comprised of many individuals who apparently have little or no scientific background (chemistry, physics, or astronomy being the only true sciences as defined by Mr. MacDonell [7]). In fact, Mr. MacDonell himself, appears to question the qualifications needed to attain membership in the IABPA [7].

Mr. MacDonell's critique of our work is confined to a single paragraph where he mentions errors that have not been properly described. One of these is the statement that our report is a "ho-hum" case. Our case report may be "ho-hum" to experienced members of the forensic science community, however, we realize that there exists a dearth of knowledge in this area. Even "ho-hum" cases can be instructive. Case reports are nearly non-existent in the English language journals and research here is also poorly represented, thus, this was the impetus to publish this case.

Mr. MacDonell's only tangible criticism of our paper cites the "absorbency coefficient" of paper toweling versus a human head. We are fully aware that there can be no comparison. In our first draft, we mentioned this, however, one reviewer chastised our "apologizing" for the inadequacy of reproducing a valid model, and these statements were removed from our final draft. Obviously, unless one takes an unwilling individual and stomps, beats, shoots, or otherwise injures that person, scientists must settle for less. Any model can be criticized for inaccuracies, whether it is a pile of paper towels or a Styrofoam head filled with bloody gelatin and coated with Liquid Rubber (with no attempt to simulate bone, hair, or skin) [9].

By not mentioning every error in our case report, Mr. MacDonell is again doing what he says he shouldn't have done with the Pizzola et al. work [2-4] by letting his interpretations pass unmentioned. If we made mistakes in our work, we want to know about them. An advantage of publishing one's work in a refereed journal is that it allows the forensic science community to evaluate and respond appropriately. This should be a learning experience for both the author(s) and readers.

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Author's Response

Sir:

This correspondence is in response to the letter written by Herbert MacDonell regarding our article published in the *Journal of Forensic Sciences* in 1986 [1]. His same letter in a slightly altered form was published recently in the International Association of Bloodstain Analysts (IABPA) Newsletter [2]. Before discussing our error in stating that Balthazard et al. [3] used "strings" in their research reported in their 1939 article there is another issue that we find more compelling, and thus we will address it first. In his letter MacDonell claims that, "As the person who 'discovered' the Balthazard article in Germany some 15 years ago, I am quite familiar with its contents." His claim of being the discoverer of the Balthazard article is not supported by historical fact. Furthermore, his own published records are inconsistent regarding this matter. Since he states that he discovered the article "some 15 years ago," that discovery would then have occurred about 1980. Yet, in his 1983 publication [4], which is a revision of his LEAA report [5], MacDonell does not even cite Balthazard et al. and states in the introduction that "Literature searched by the author contains little beyond elementary rules for establishing the direction of travel . . ." In fact, it took MacDonell an additional decade to cite the ". . . classic work of Balthazard et al. . . ." at which point he stated that he did not have time to include it in his 1983 report [6,7]. This behavior is bizarre since one would think that three years is sufficient time to at least cite a 65 page reference that over a decade later he considered to be a "classic."

Although he would not claim to be the "discoverer," Pizzola's earliest awareness of the work of Balthazard et al. dates back to 1983, while conducting a literature search as part of his thesis preparation under De Forest [8]. This was from a citation in the text of De Forest, Gaensslen, and Lee [9]. For further information De Forest referred Pizzola to an article written by Thornton in 1975 [10], which provided the specific bibliographic citation for the Balthazard article. Thornton reported that Balthazard et al. had studied "patterns of blood spattering." Pizzola located (did not discover) the article in the original journal in the John Jay College of Criminal Justice library stacks. Not being fluent in French, he had portions of this translated by an acquaintance. He was surprised to find such an extensive scientific work regarding the subject of bloodstain pattern interpretation given that MacDonell had previously stated in 1973 that, "Literature searched covering the period 1930 through 1954 did not disclose any significant contributions to the importance of bloodstain geometry" [11]. Pizzola was very excited on learning what had been done by these four French researchers and decided to review it, in outline form, in his thesis. Two pages were devoted to a discussion of this seminal paper. The purpose of this review was to draw attention to the considerable effort that these French scientists had made and to provide some knowledge of what was contained in the extensive paper to others

in the field of criminalistics. In any event, Thornton was certainly aware of Balthazard et al. far in advance of MacDonell's earliest claims, which were not documented until the early 1990s [6,7]. In fact, Thornton recently informed us that he found Balthazard's article in the early 1960s (17 to 20 years ahead of either of MacDonell's claims), three decades before MacDonell first cited it.

After obtaining a more accurate translation of the pertinent portion of the French researchers' paper and a more careful review of the article in response to MacDonell's letter, we agree with MacDonell that we have erred with respect to the specific mention of "strings." This error first appeared in Pizzola's thesis [8], and continued in the 1986 paper criticized by MacDonell [1]. We accept responsibility for our "error." However, unlike MacDonell's earlier errors, which were the basis of our criticisms to which he refers in his letter in the IABPA newsletter, ours is not substantive [2]. It in no way could adversely affect someone's interpretative work in crime scene reconstruction. It is clear that although Balthazard et al. may well have done the obvious and used strings in their back projection research, there is no explicit mention of the word "strings" in the article. The availability of a more careful translation of the article written by Balthazard et al. would have prevented this error. Nonetheless, it is clear that Balthazard et al. proposed methods for ascertaining both the azimuth and elevation angles from individual droplet stains and were keenly aware of the utility of estimating the point of origin of a group of bloodstains by back-projecting to a point of convergence in three dimensional space. The reader is referred to Fig. 34 on page 306 of their article where the projection is on a plane [3]. We trust that even the casual reader would enjoy learning about the significant effort that was made and published by these French scientists in 1939. The particular device used to help visualize the convergence of back projections from droplet stain patterns is far less significant than is the concept of developing and using the back projections themselves. The literature is clear that the concept of back projections and their use with respect to both the azimuth and elevation angle is attributable to Balthazard et al. Piotrowski's earlier work is comprehensive, but descriptive only and confined to pattern typologies [12].

There are far more fundamental problems to be dealt with than that of who first used the "string method." The use of strings in certain circumstances would be obvious to anyone familiar with the concept of back projection. It is no more significant than using a string as an approximation of a bullet trajectory. The use is similar and suffers from many of the same limitations. MacDonell's claim to priority for a trivial technique seems curious. If MacDonell is seeking to claim priority for using strings, his claim is weakened by his own acknowledgments in his letter of Dr. Paul Kirk's 1955 work in the Sheppard case affidavit and by the flimsiness of his undocumented "remembrances." It is also curious that if MacDonell thinks that the use of strings is so significant its first appearance in his own writings takes place over 15 years later in 1971 [5]. Since MacDonell's work published in 1971 is largely a duplication of the work of Balthazard et al. published in 1939 MacDonell has a problem if he were to claim to have "discovered" it prior to 1971 [7]. In any case, MacDonell's failure to cite the work of Balthazard et al. prior to 1992 calls for a better explanation. Those proffered "don't wash."

In conclusion, we think that it would have been more construc-

tive for MacDonell to have spent time reviewing and reporting on the substance of Balthazard's work while spending less time discussing what is not contained in the article and claiming to be its "discoverer." We have endeavored to make criminalists more aware of the Balthazard article because we felt that the work of Balthazard et al. had not received the attention it deserved from those concentrating in this special area of criminalistics, and because it contains useful information pertinent to the subject of crime scene reconstruction. Finally, we wish that MacDonell had brought this error to our attention earlier so that others may have been spared from repeating the attribution of the use of "strings" rather than the significant concept of back projection to Balthazard et al.

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