

June 1930

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Recommended Citation

William M. James, *Expert Evidence in Ballistics*, 8 Chi.-Kent L. Rev. 33 (1930).

Available at: <https://scholarship.kentlaw.iit.edu/cklawreview/vol8/iss3/3>

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EXPERT EVIDENCE IN BALLISTICS

WILLIAM MCGEE JAMES*

Inventions and innovations of late years have greatly affected the home, the factory, and the store. Scientists and inventors have devoted most of their efforts toward improving living and working conditions and heretofore have neglected the courts and the administration of justice. Through the efforts of the press and various individuals who have become interested in the administration of justice, the attention of science has been recently directed to the detection and prosecution of criminals. As a consequence, efforts have been made to use the phonograph, the moving picture machine, the lie-detector and other inventions and sciences, not the least important of which is the science of ballistics. This article is confined to what is now commonly referred to as the science of ballistics. It is not the author's intention to prove that the testimony of a ballistic expert should or should not be admitted in the trial of a criminal case, but rather to discuss the more important legal questions resulting from the use of this comparatively new science.

The evidence of ballistic experts in criminal cases is now frequently applied to identifying a particular gun from which a designated bullet has been fired, or in which a designated shell has been exploded. In order to understand the legal aspects of the question, it would seem appropriate at this point to select the testimony of a ballistic expert and abstract the same. While the testimony of the expert in any given case will depend largely upon the individual facts in the case, nevertheless the testimony in the different cases must necessarily follow somewhat the same lines. Let us assume a criminal case involving the trial of several defendants on a charge of murder, where it is sought to prove by a ballistic expert that a bullet which has been introduced in evidence has been fired from a revolver which has been introduced in

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evidence, and that certain discharged shotgun shells which have likewise been introduced in evidence, have been fired from a shotgun which has also been admitted in evidence. The testimony of the expert we will assume is substantially as follows:

My name is X. I am a consultant on small arms and projectiles in civil and criminal cases, and devote all of my time to this sort of work. I have the following preliminary education to fit me for my present occupation: An A.B. degree from John Hopkins University in Baltimore and an M.B. degree from the same University, and I am a graduate of the Army Medical School in Washington. I am a Lieutenant Colonel in the Ordinance Reserve in the United States Army at the present time. At the age of fifteen I began visiting munition factories, and, as the opportunity presented itself, I have studied their methods of manufacturing small arms, and have visited practically every manufacturer of fire arms in this country. I have studied the methods of the various factories, and as an Ordinance Officer, I have been on duty at government arsenals and taken part in the manufacture of fire arms including revolvers, pistols, small arms, munitions and ammunitions used in such arms, and also the powders that are used therein. I have made a study of the literature of all available languages on the identification of fire arms, and for a period of years I have collected the necessary data and specimens which figure in my work. I have been consulted by experts associated with the governments of foreign nations relative to the manufacturing of fire arms. I have in my possession thousands of specimens of unfired and fired bullets and shells, some scores of specimens of different types of powder used in small arms' ammunitions, many hundreds of specimens of arms which I use for comparison and reference work, and numerous instruments of precision in the form of microscopes, gauges, micro-meters and phonographic apparatus, many of which have been made for my work alone. It is possible to tell by examining a fired bullet what company made the bullet. By the use of a blackboard I will illustrate to the court

and jury the method used by me in identifying the source and manufacture of a bullet. Peoples Exhibit No. A which has just been shown to me, is a fired lead mushroom bullet, flattened out on the nose, the nose containing dark material which was evidently picked up in its flight. Its caliber, although it is very much distorted both at the nose and base, is what is commonly known as a .38, and it shows on its surface the imprint of five right wing grooves inclined to the right. From my experience I should say a .38 caliber gun fired the bullet which has been shown to me. Furthermore, from my experience and study and experiments in connection with the evidence bullet, I can tell what make of gun fired the bullet and I can say whether or not I have seen the gun that fired the bullet. Peoples Exhibit No. B is a .38 caliber Smith & Wesson revolver known as the military and police type, or Model No. 1905, handling .38 short and long colt and .38 Smith & Wesson special, and .38 colt special ammunition. In my opinion that is the gun that fired Peoples Exhibit No. A, and I have made an experiment to determine whether or not my opinion is true. The experiment I have made is as follows: I have examined the interior of this arm and cylinder. It was foul and the fouling was of a black powder type. The bullet in evidence gave evidence of having passed thru a barrel that was quite foul. It was of a caliber and type compatible with having been fired thru an arm such as this. I therefore secured ammunition as similar to the bullet in evidence as I was able to secure of the same caliber and type, loaded with black powder, and thereupon fired a specimen thru the barrel of this weapon into a container full of cotton waste and compared it with the bullet in evidence under a microscope. The markings on those two bullets were largely identical, black powder leaving very large residue on firing, causing a considerable variation in markings from shot to shot by reason of the fact that some residue is fired out on each shot and new residue is left. The residue acts as a foreign substance which marks each bullet and puts temporary markings on each bullet which

in some measure obscures the permanent markings of the barrel. In spite of variations in temporary markings there are present enough permanent markings to satisfy me that the bulletin in evidence has been fired thru the weapon in evidence. In the first place, the evidence bullet bears five grooves inclined to the right. Of the arms which have been shown to me, the only one which bears five grooves inclined to the right is the Smith & Wesson. This bullet weights 150 grains and was of a type not compatible with its having been fired thru an arm chambered for a .38 Smith & Wesson, but was of a type compatible with having been fired thru an arm chambered for the Smith & Wesson .38 special. The arm in question is chambered for the .38 Smith & Wesson special cartridge but does not handle the .38 Smith & Wesson bullet. I compared the test bullet to which I have previously referred to, with the evidence bullet under a microscope. The width of the grooves and the angles of the grooves of the evidence bullet coincide with the width and angle of the grooves present on the test bullet which I fired. No two arms' makers, even though they use the same number of grooves inclined in the same direction, ever use grooves of the same width and angle. A comparison microscope consists of two ordinary microscopes placed side by side and joined at their tops by a cross arm which contains prisms. We will indicate (drawing on blackboard) a single microscope beneath which we have placed a bullet which we will call the evidence bullet. Beneath another microscope placed beside the first one, we locate the test bullet I fired through the arm under study. I illustrate the single groove on each of these bullets being a groove left on their surface by the barrel through which they pass. These two microscopes are in turn connected as I previously explained, with a cross arm which bears in its ends a set of prisms. The images of these bullets travel up the tops of the microscope and strike these prisms which reflect these images inward at an angle of 90°. They then strike the second set of prisms which reflect them upwards, side by side in a single eye piece which is di-

vided into two equal parts. If we look into this eye piece, we see a composite image composed in part of the evidence bulletin and of the test bullet. We rotate our evidence bullet into such a position that the groove left on it by the barrel comes well into view. We then leave that bullet alone. The bullets are held on little rotating mounts whereby they may be rotated readily, and fixed on these mounts by wax, so that they will not be grasped by anything mechanical which would leave on them marks which they had not previously received. Having brought the evidence bullet to rest, we rotate the test bullet in such a fashion as to bring up a groove and match it on the fixed groove on our evidence bullet. If these bullets are through an arm of the same make and caliber, the grooved edges will fuse, and will match for width, for angle, for number and for direction, and in addition, where they have been fired through the same arm, a certain number of very fine microscopic lines will be found flowing together and across our dividing line and furnishing numerous points of identification. This is by reason of the fact that in the rifling of an arm, certain variations develop in the individual grooves of that particular arm. The arm prior to rifling is a perfectly smooth barrel which is supposed to represent a circle and through which a rifling rod is passed which bears a cutter in a slot near its end. An illustration of a rifling rod would be like this (illustrating on blackboard a rifling rod and explaining the illustration as follows): This is a circular tube just shy of a diameter of the barrel of a gun. The cutting edge which is destined to scrape out the grooves in the barrel is passed through the barrel and it emerges from the barrel. The cutting edge is automatically jacked up enough so that when the cutter is withdrawn through the barrel the cutting edge will gouge out a fine groove. The entire depth of the groove is not made by one stroke, one stroke removing a fraction of a thousandth of an inch of metal. The cutter is drawn through the barrel on a spiral movement, cutting a shallow spiral groove in the surface of the metal, the spiral corresponding with the make of the arm

and the number of grooves desired. The cutting edge is automatically withdrawn below the surface, so that when the rifling head is returned it will not cut off the forward stroke. The entire barrel is then brought around so that the first groove is moved out of the way and a portion of the barrel which is to be the location of the second groove is brought into place. This process is repeated until the desired number of grooves have been started. When the cutter comes back to groove number one, it is raised a trifle higher, so that when it is next drawn through the barrel, it will deepen the first groove. This process is then repeated on each groove the required number of times until the groove has been cut to the required depth which in American arms varies from three to five thousandths of an inch. This cutting edge theoretically is a perfect arm cutting a perfect tract shaped groove in the bore of the arm. It actually is impossible to make a good tool with a perfect edge as is illustrated by pictures of a razor blade under a microscope, and instead of this edge being perfect, it has fine irregularities. Metal against metal always results in wear, so that these irregularities are constantly changing as the cutting tool is being drawn through the barrel, the result being that the marks which are present in groove number two differ materially from those which are present in groove number one, and so on in each groove. The grooves are the same width and the same depth, but these little things present in the bottom of the grooves differ in different barrels, and when we compare two bullets fired through the same barrel, we can find lines on their surfaces which emerge at the same point which are more or less permanent, depending on whether the barrel was in the same condition when the two bullets were fired or in a different condition, but always more or less lines being present identically upon both bullets. It was on this basis that I made my comparison of the evidence bullet and the test bullet which I had fired, and found enough lines identical upon the two to satisfy me that both had passed through the same barrel. In regard to the discharged shotgun shells which have been introduced in evidence, it

is my opinion that they were fired in Exhibit No. C (Exhibit No. C being a sawed off shotgun). I arrived at my opinion by firing cartridges of the same make and type, through States Exhibit No. C, being the evidence shotgun, and comparing the imprints of the firing pins left in the primers of those cartridges with the imprints of the firing pins left in the primers of the two shotgun shells which had been introduced in evidence, and also comparing the marks left by recoil against the breach of the arm on the two shells fired experimentally with similar marks left on the two evidence shells. I can tell from my experiment just which barrel of the shotgun, States Exhibit No. D (being a discharged shotgun shell) was shot from. I based my opinion upon the following: No two firing pins are identically alike even though they are in the same double barrel shotgun, because in the course of manufacture they are subject to variations due to the wear of the tools which form them, the result being that each firing pin bears on its tip a series of concentric circles left by minute irregularities on the cutting edge which shapes that tip off to a rounded form. Firing pins made in succession will bear a different series of circles due to the wear of the cutting tool and to the hardness of metal that firing pins are composed of, the result being that when a given firing pin leaves an imprint on the primer of a shell, an examination of that imprint will show a series of circles, all with the same center and varying in diameter. Another firing pin if made immediately afterward on the same machine, will leave a series of circles on the primers which it explodes, but these circles will not be of the same diameter as those in the preceding firing pin, hence, by comparing two shells exploded with the same firing pin, we get out circles of the same number and diameter. If the shells were exploded with different firing pins the circles are usually different in number and in diameter, or both. We also have this additional factor. When a shell is exploded, a pressure of three to five tons to a square inch is developed, and the pressure slams the shell against the breach of the arm with the same force that it drives

the charge down the barrel. The breach of the arm bears the marks of the tool that machined it. It also bears the mark of the file which has been used on it to smooth off the surface and take away all irregularities. These file marks differ in each arm and they differ on various parts of the same breach, and the shell when it recoils against the breach picks up these marks on the soft copper cap which comes in contact with the breach. The caps fired from the same barrel with the same arm will take up the same series of file markings on the steel breach. A shell fired in another barrel will take up a different series of markings.

As has been heretofore suggested the foregoing testimony could and perhaps would in another case, differ somewhat, depending upon the circumstances, but it is hoped that it is sufficiently complete to make it possible for the reader to understand the legal questions which arise in determining whether or not the testimony of such an expert can or should be admitted in evidence and if so under what circumstances. The question of the admissibility of this type of evidence suggests a number of interesting questions among the foremost of which are the following: First—what are the objections to the testimony of a ballistic expert and what are the arguments in favor of the admission of such testimony; Second—if the testimony of a ballistic expert is to be admitted what evidence must be introduced in order to procure the admission in evidence of the bullets, shot-gun shells, or guns which it is alleged have been used in the perpetration of the crime in question and to which his testimony will be confined; Third—if the expert is permitted to testify at all, should he be allowed to give his opinion as to whether or not the evidence bullet or shell has been fired from the evidence gun or should his testimony be restricted to explaining wherein the experimental bullets or shells are similar to the evidence bullets or shells; Fourth—should the witness, if he is allowed to give his opinion, be permitted to explain the basis of his opinion as by the use of a blackboard, or the exhibition to the jury of the experimental shells, bullets,

shot gun wadding etc. and Fifth—what qualifications must the witness have in order to qualify himself as a ballistic expert.

In order to determine the answers to the question "What are the objections to the testimony of a ballistic expert and what are the arguments in favor of the admission of such testimony," let us first consider one of the cases in which evidence has been introduced relative to the use and identification of firearms and bullets. In *Meyers v. The State*, 14 Tex. Ct. App. 35, the defendant was on trial for assault with intent to murder. One of the witnesses, called on behalf of the state, testified that at the time he arrested the defendant (at the house of the defendant), he found a double barreled shotgun with the left tube broken, that the right-hand barrel was loaded and damp, and the wadding was found to be powder burned and the cap was not bright. The witness had had considerable experience in the use of firearms and gave it as his opinion that this barrel had been recently discharged. Another witness called on behalf of the state, who was likewise experienced in the use of firearms, was also permitted to state that in his opinion the gun in question had been recently discharged. The introduction of this evidence was assigned by the plaintiff in error as ground for reversal. In discussing the evidence, the court said:

"Where the use of firearms is as common as in this country, it can scarcely be said to be a matter of peculiar skill to determine whether or not a firearm has been recently discharged. If, however, it is necessary that a witness should qualify himself as an expert before his testimony is admissible as to that fact, then we think the witnesses in this case qualified themselves sufficiently before testifying as to their opinion on the subject. They showed they had had experience in the use and handling of firearms, and stated that they inserted the finger into the muzzle of the defendant's gun, and when the finger was withdrawn it was wet and black, from which, in their opinion, the gun must have been recently discharged. (*Connor v. Sturtevant*, 117 Mass. 122). As expert testimony, the court did not err in admitting the evidence."

While the opinion in this case does not disclose with particularity, the objection which was made to the testimony of the two witnesses as heretofore outlined, it appears from the court's discussion of the evidence that it was the contention of the defendant that the matter testified to by the witnesses was not the subject of expert testimony, but consisted of matters of common knowledge which any one who was in the slightest degree acquainted with firearms could have given.

In the case of *State v. Jones*, 41 Kas. 309, 21 Pac. 265, the defendant was on trial for murder. There were but two witnesses to the homicide; one, the defendant, who claimed he acted in self defense, testified he was only seven or eight feet from the deceased when he discharged his gun and killed the deceased; the other, a ten year old son of the deceased, said the defendant was more than seventy feet distant from the deceased when the deceased was killed. The examination of the wound disclosed that the shot entered the body of the deceased within a space of two inches in diameter with the exception of three or four shot just outside of this space. At the trial in the lower court the defendant offered the testimony of two witnesses for the purpose of showing from the nature and size of the wound, the proximate distance the defendant must have been from the deceased at the time of the shooting. One of the witnesses by the name of McLaughlin, testified that he was a manufacturer and trader in breech and muzzle loading guns; that he was a gunsmith by trade, and had been in the business for 30 years; that he had experimented with guns and muskets such as the one used by the defendant; that it had been a study with him, and with men in his business, to find how guns could be manufactured to throw shot compactly for a distance, and that they tried to manufacture improved guns which would increase the distance they would thus carry a load of shot; that by experiment and study he had obtained a definite and accurate knowledge of how far shotguns of all kinds would carry without scattering. He further stated that he had sufficient experience to tell from the character of the

wound about the distance the gun discharged would be from the person shot; that he had experimented himself, and seen others experiment, with shotguns and muskets, when loaded with powder and double B shot, to see how far they would carry without scattering. He was then asked:

Question. From such experiment and observation, are you able to tell with any degree of accuracy how far such a gun would throw shot without scattering beyond what would be a distance two inches in diameter, with four or five shots just around the edge of the space two inches in diameter? Answer. I can state the distance within which such a shot would necessarily be made.

Question. State what the distance would be. (Objected to on the ground that said question is one of fact for the jury, and not such a one as requires the opinion of an expert.) The court sustained the objection to this and other questions of like character which were asked. In passing on the ruling of the lower court in sustaining the foregoing objections, the Supreme Court of Kansas said:

“We believe that the evidence sought to be introduced by these questions was competent, and that its rejection was error. It was material testimony in this case. The testimony of Jones, the defendant, and this lad, were upon two theories of the case, and were distinctly inconsistent. One had testified that the parties were only 7 feet apart at the time of the shooting, while the other had located them from 60 to 100 feet from each other. It became a matter of vital importance to determine which account of the homicide was truthful,—that of the boy or of the defendant. One of the important facts to be found by the jury was the distance the defendant and deceased were from each other when the fatal shot was fired. The determination of that disputed question would have in this case very great importance in determining whether the testimony of the boy, White, or the defendant should have been given greater credence. If the boy’s testimony was true, then the defendant was guilty of murder in the first degree, beyond a reasonable

doubt; and, on the other hand, it is equally plain, if the defendant told the truth, he certainly was not guilty of that degree of homicide. *If there is any rule known by those who have made the use of firearms a special study, showing at what distance shot could be thrown compactly, and at what distance they would scatter, it should have been given to the jury, either as a corroboration or refutation of either the defendant or of the young lad, White. The theory of the state is that this testimony was not expert testimony; that the jury was as competent to determine the distance the parties were apart when deceased was shot as the gunsmith; and it cites a long list of authorities to support its contention. We have examined all that have been cited, and believe that no one of them is applicable to this case. They are all based upon the question of the relative position of the parties to a homicide, showing from what direction the shot was fired, and whether the assailant was at the front, side, or back of the party killed. None of these authorities reach the question here in dispute. It is not whether Jones was at the left side of White; that he was on higher ground or lower ground; or that he stood north, south, east, or west of the party killed,—but how far was he from him. If that was a matter that could be determined by an experienced man from the size of the wound, then this testimony would not have been expert testimony. On this subject Mr. McLaughlin testified that he and others in his trade had made it a study to devise methods for shooting shot a long distance compactly, and that by reason of his study and observation he was able accurately to state how far shot could be thrown from the musket in question. We are of the opinion that very few men have any definite or accurate idea of the manner and distance shot would scatter when fired from a gun. Of course, all know that they are discharged in a compact body from the muzzle of the gun, but how far they go before they begin to separate, and the extent or the relation of the distance from the gun to their separation from each other, is a subject upon which one, without special experience and study,*

could not even make an intelligent guess. In other words, this is a question of science, to be ascertained by study and experience, and does not come within the common knowledge of men."

It is worth noting that in the foregoing case the objection to the testimony of the firearms' expert was again based on the fact that the matter which he was testifying to was not a proper subject for expert testimony. It is also worth noting that the testimony of the witness in this case was confined to the manner in which shot would separate when fired from a shotgun. This testimony was, therefore, confined largely to what would probably be classed as external ballistics. The opinion is important, however, because it recognizes that the study of firearms and ammunition used therein is a scientific subject.

In *Moughon v. The State of Georgia*, 57 Ga. 102, the defendant was on trial for the offense of assault with intent to murder. In this case it was held that "the opinion of a witness experienced in the use of guns, as to the length of time since a gun was fired off, is admissible evidence in connection with the facts on which it is founded, and that the shot found (next day after the shooting) in one barrel of the prisoner's gun, the other being empty, were compared with those which lodged in and about the person assaulted, and were like them, is admissible evidence.

Thus it is clear that this court recognized that it was proper to permit evidence to be introduced relative to the use of the firearm which it was claimed had been used in the perpetration of the crime for which the defendant was being tried.

In *Commonwealth v. Best*, 180 Mass. 492, 62 N. E. 748, the government contended that the deceased was shot with a Winchester rifle that was in the kitchen of the house occupied by the defendant. Two bullets were found in the body of the deceased and the government was allowed to prove that another bullet of the same calibre had been pushed through the rifle on or shortly after October 24, which latter date was about two weeks

after the crime in question had been committed. The prosecution was then allowed to put this bullet in evidence and also photographs from this and the two bullets from the body in order to show that the marks from the rifle in the two cases coincided so closely as to prove that all three bullets had passed through the same rifle barrel. This evidence was objected to by the defendant. The court in its opinion said:

“The main ground seems to be that the conditions of the experiment did not correspond accurately with those of the date of the shooting, that the force impelling the different bullets were different in kind, that the rifle barrel might be supposed to have rusted more in the little more than a fortnight that had intervened, and that it was fired three times on October 10, which would have increased the leading of the barrel. We see no other way in which the jury could have learned so intelligently how that gun barrel would have marked a lead bullet fired through it, a question of much importance to the case. Not only was it the best evidence attainable but the sources of error suggested were trifling. The photographs avowedly were arranged to bring out the likeness in the marking of the different bullets and were objected to on this further ground. But the jury could correct them by inspection of the originals, if there were other aspects more favorable to the defense.”

With reference to the bullets found in the body an expert was allowed to testify that they were marked by rust in the same way that they would have been if they had been fired through the rifle found at the farm, and that it took at least several months for the rust that he saw in the rifle to form. It is objected that these were not matters for expert testimony and the court said: “We see no reason to doubt that the testimony was properly admitted.”

In none of the foregoing cases which have been cited, did the witnesses give testimony which corresponded exactly with the testimony which has been outlined in the early part of this article. Nevertheless the cases are sufficiently similar to be classed in one group. There

are, however, other objections to the testimony of the type given by the witness, X, which have been suggested from time to time by persons who are familiar with criminal procedure and the trial of criminal cases. In the first place, the remarkable lack of authorities upon the question indicates that the subject is rather new and novel, and therefore, according to the theory of some, it is unreliable. The courts have given some recognition to the doctrine that evidence is inadmissible when it is new and novel in type and has not yet stood the test of time or is too unreliable to be safe.

The Supreme Court of Illinois substantially recognized this doctrine in the case of *People v. Pfanschmidt*, 262 Ill. 411, where it was sought to introduce evidence relative to the conduct of bloodhounds. In commenting on the evidence which was introduced in this case as to the manner in which the bloodhounds had acted, the court, after discussing the preliminary evidence which had been introduced, state:

“We agree fully with the statement in *Brott v. State*, *supra*, [70 Nebr. 395, 97 N. W. Rep. 593] that the ‘conclusions of the bloodhound are generally too unreliable to be accepted as evidence in either civil or criminal cases.’ ”

The court further cited with approval the following language from *Brott v. State*, *supra*:

“The bloodhound is, we admit, frequently right in his conclusions, but that he is frequently wrong is a fact well attested by experience. * * * *It is unsafe evidence, and both reason and instinct condemn it.*”

In the case of a ballistic expert's testimony it has been contended that such evidence is too new and novel to warrant considering it as safe evidence, and if a court were to adopt this contention it apparently would have to rule out such evidence if the court in question recognized, as did the Illinois court, that evidence which is unsafe should not be admitted in the trial of a criminal case. Furthermore, this type of evidence has been objected to on the theory that the evidence bullet which has been extracted from the wounded or deceased person

may have become so materially distorted as to mislead the expert. For example, the bullet may have struck a bone in the body or it may have come in contact with metal or acid after being fired from the gun, and thereby have become so distorted as to mislead the expert, thus rendering the testimony of the expert unreliable. These objections, however, would appear to go rather to the weight of the evidence than to the admissibility of the evidence. Also, there is the further objection that the testimony of a ballistic expert is usually the outgrowth of experiments made out of the presence of the defendant, and that the defendant having no opportunity to make a similar experiment, cannot meet the testimony of the expert, except, possibly, by cross-examination. Perhaps this objection is of a more practical than a legal nature, though the Supreme Court of Illinois in *Painter v. The People*, 147 Ill. 444, indicated that it was not greatly in favor of evidence which was based on experiments made before the trial. The court in its opinion said:

“But it is said that the testimony of these witnesses that they saw and were able to recognize and clearly identify the defendant in the hall below can not be true because certain gentlemen subsequently tried the experiment of placing themselves in the same position and with like surroundings, and were unable to recognize the countenance or dress of persons passing through the hall. It might perhaps be said that this experiment is fairly offset by a counter experiment afterwards made by witnesses for the prosecution, in which precisely the opposite result was reached. *But if proof of such experiments is competent at all, it is manifest that it is entitled to but little weight, owing to the difficulty if not impossibility of knowing that the experiments were made under substantially the same conditions which were present at the time these witnesses claim to have seen the defendant come out of the apartments where the domicile had just been committed.*”

The objection of the court to the experiment in this case was apparently founded upon the impossibility of

knowing that the experiments were made under substantially the same conditions which were present when the crime was committed. By using care in making his experiments, a ballistic expert could undoubtedly conduct them under substantially the same circumstances as existed when the crime had been committed. For instance, he could obtain a shell of the same make containing substantially the same amount of powder and lead bullets as the evidence shells, could fire them into a substance which would give practically the same resistance as the human body and thereby meet the objection to evidence based on experiments, as outlined by the Supreme Court of Illinois in *Painter v. The People, supra*. In *Ulrich v. The People*, 39 Mich. 245, evidence was offered to show that a month or six weeks after the crime in question had been committed, an examination was made in the wheat field, and again after the wheat was harvested, and that no signs of a struggle were then discovered. The court said in considering this evidence:

“This was very properly excluded as being altogether too remote to be entitled to any consideration in the case. The same is true of the experiments made in attempting to lift girls over this fence for the purpose of contradicting the girl wherein she testified that the respondent had dragged her over the fence. Whether she was literally dragged over by force or got over voluntarily through fear was of but slight consequence in the case. *Manufactured evidence is not the most reliable, and the cases are few where it ever should be admitted. This is not one of them.*”

The Supreme Court of Michigan was apparently of the opinion that evidence which was founded upon experiments was in the nature of manufactured evidence and should therefore be admitted with great care. In view of the attitude of the Illinois Court and the Michigan Court in the last two mentioned cases, it is apparent that there is some merit to the contention that the testimony of a ballistic expert should not be admitted because it is founded upon experiments. On the other hand, if great care is used in making the experiments, it would seem that this objection would be overcome.

Proponents of ballistic evidence either deny that there is any merit to the foregoing objections or say that if there is any merit to the objections these objections must give way to new ideas and modern methods and that if the courts are going to keep abreast of the times a more liberal attitude toward evidence of a scientific nature must be adopted. There is a great deal of common sense in this contention, particularly when one considers that the criminal in his operations ordinarily has unlimited use of modern appliances such as automobiles, machine guns, airplanes, etc.

In order to get a clearer understanding of the other legal aspects of this very important question, let us assume for the sake of argument, that ballistic evidence developed to its highest point of efficiency as outlined by the testimony of the witness X, is to be admitted in the trial of criminal cases. This leads us to a discussion of the second point, namely, "What evidence must be introduced in order to procure the admission in evidence of the bullets, shotgun shells or guns which it is alleged have been used in the perpetration of the crime in question, and to which the testimony of the ballistic expert will be confined." As has been suggested before, it is possible that the evidence bullet may have become distorted through contact with a bone in the human body or through contact with the steel forceps used by the physician in removing the bullet, or through contact with the container in which the bullet is placed after it has been removed from the body, or by coming in contact with acids or any other external substance which may affect the condition of the evidence bullet, or could conceivably affect the condition of the evidence gun or shotgun shells, as the case may be. It is apparent that great care should be taken in handling the exhibits which are to be introduced in evidence, particularly prior to the time when the ballistic expert makes his experiment. There is a case in Illinois where the court has had occasion to discuss this proposition. In *People v. Berkman*, 307 Ill. 492, the State in the lower court was permitted to introduce in evidence one of the bullets which was

claimed to have been fired into the body of the assailed and which the evidence showed to be a bullet fired from a thirty-two caliber gun. The exhibit was not identified as the same bullet that was extracted by the physician from the back of the assailed. The physician testified on the trial that he could not identify it as the same bullet that he had cut out of the back of the assailed, that after he took it out of his back he handed it to a nurse, but the witness did not give the name of the nurse. The only other evidence concerning the identify of the bullet was given by the person who had been assailed, who testified that one of the nurses handed him the bullet and said that it was the bullet that was cut out of his back by the physician, but the witness did not give the name of the nurse. The court said, when commenting on this evidence:

“Exhibits of this character are not admissible as evidence until they are clearly identified.”

The revolver which had been found the next morning near where the defendant was lying in the prairie after he had been shot by the officer was also introduced in evidence. In discussing this evidence the court said:

“This revolver was not shown by competent evidence to be the revolver with which Rahn was shot a month before it was found. Even if it could be said that the proof showed by circumstances that this was a revolver in the possession of the defendant on the night of April 13th. It was not proof of the fact that he had this gun on March 13 and was the gun which he shot Rahn.”

After the introduction of the gun and bullet, the State undertook to prove by the opinion evidence of one officer Dickson that this revolver was the identical revolver from which the bullet introduced in evidence was fired on the night Rahn was shot. Without commenting at this time on the attitude of the court toward the evidence of Officer Dickson it is sufficient to note that the foregoing decision readily recognizes that exhibits of this character are not to be admitted in evidence until they are clearly identified. While this would probably be true in any case, it would seem to be particularly true

in cases where a ballistic expert is to testify. In the case of *State v. Hossack*, 116 Ia. 184, 89 N. W. 1077, on the morning after the homicide the sheriff took three hairs from the ax which was found under the grainery, put them in his pocketbook, and some days after they were placed in a bottle which he delivered to the county attorney. Later, the body of the deceased was exhumed and some hair taken from his head near the wounds, by the sheriff. After this the witness, with the county attorney, went to an expert. The witness delivered to the expert the hairs he had taken from the head of the corpse and the county attorney delivered to the expert a bottle containing three hairs, supposedly the ones taken from the ax, but there was no other evidence to identify or show how they had been kept while in the possession of the county attorney. The expert was called on the stand as a witness for the State and gave evidence tending to identify at least one of the three hairs taken from the ax, as a human hair and similar to those taken from the head of the deceased. No objection was made at the time to this testimony, but thereafter, when the State offered the three hairs examined by the expert and supposedly taken from the ax in evidence, on objection of the defendant they were ruled out as not being properly identified nor anything shown as to the manner in which they were kept by the county attorney. But a motion made by defendant to strike out the evidence of the expert with relation to the hairs was overruled. In commenting on this the court said:

“If the hairs were not admissible, it is difficult to perceive why the evidence in relation to them was retained. In criminal cases we are not so strict in holding parties to a timely objection to testimony as in civil causes. If this testimony was not admissible, it should have been ruled out on motion. *It is thought by the State that, as the hairs were traced into the possession of the county attorney, the presumption that he did his duty in the matter will sustain the conclusion that the hairs were not tampered with while in his possession.* But it is no more the duty of the county attorney than

of any other person to preserve and care for such articles. It was not his duty to take them into his custody at all. He might well have left them with the sheriff. *In cases of this kind preliminary proof of the identity of the thing submitted to the expert, and that it has not been tampered with, is required.* Rog. Exp. Test. 110; *State v. Cook*, 17 Kan. 394. The evidence of the expert should have been excluded."

The Iowa court clearly recognized that preliminary proof of the identity of the things submitted to the expert, and that they have not been tampered with, is required. While this case did not involve the testimony of a ballistic expert, by analogy it would seem reasonable to assume that the requirement outlined by the Iowa court would apply with equal or greater force to objects which are going to be introduced in evidence and have been the object of experiments by a ballistic expert. The safest rule for the court to follow in the matter of preliminary proof would be to require the State to bring in all of the witnesses who had the custody of the exhibits prior to their introduction in evidence, and to establish by a connected chain, not only the connection between the exhibits and the crime but also that the exhibits when offered in evidence were in the same condition as when each had last seen them.

Having now considered the preliminary evidence which must be introduced to lay the foundation for the testimony of the ballistic expert, let us consider the third subject which has been heretofore outlined for discussion.

"If the expert is permitted to testify, should he be allowed to give his opinion as to whether or not the evidence bullet or shell had been fired from the evidence gun, or should his testimony be restricted to explaining wherein the experimental bullet or shells are similar to the evidence bullet or shells."

The answer to this question would seem to depend on whether or not the court recognizes ballistics as a science. If it is recognized as a science, then the expert would be justified in giving his opinion. If it is not

recognized as a science, then the expert should be limited to explaining wherein the experimental bullet or shells are similar to the evidence bullet or shells. In *People v. Berkman, supra*, the State undertook to prove by the opinion evidence of one Officer Dickson that the revolver which had been introduced in evidence was the identical revolver from which the bullet introduced in evidence was fired on the night the person assailed was shot. After testifying as to his qualifications the witness was asked to examine the revolver in question and gave it as his opinion that the bullet introduced in evidence was fired from the revolver in evidence. He stated positively that he knew that the bullet came out of the barrel of that revolver because the rifling marks of the bullet fitted into the rifling of the revolver in question, and that the markings on that particular bullet were peculiar because they came clear up on the steel of the bullet. The court in commenting on this evidence said:

“There is no evidence in the case by which this officer claims to be an expert, that shows that he knew anything about how Colt automatic revolvers are made and how they are rifled. There is no testimony in the record showing that the revolver in question was rifled in a manner different from all others of its model, and we feel very sure that no such evidence could be produced. The evidence of this officer is clearly absurd, besides not being based upon any known rule that would make it admissible. If the real facts were brought out, it would undoubtedly show that all Colt revolvers of the same model and of the same caliber are rifled precisely in the same manner, and a statement that one can know that a certain bullet was fired out of a thirty-two caliber revolver, when there are hundreds and perhaps thousands of others rifled in precisely the same manner and of precisely the same character, is preposterous.

“There are many instances in which opinion evidence is admissible on the part of both expert and non-expert witnesses. The speed of trains, of automobiles, of horses, values of property, sanity or insanity, intoxication of individuals, physical condition of a person, size

and color and weight of objects, and many other such facts may be shown by opinion evidence when such opinion is based upon proper facts and opportunity of the witness to observe the things or persons and where it is impossible for the witness to detail all pertinent facts in such a manner as to enable the jury to form a conclusion without the opinion of the witness. The general rule that facts, and not conclusions should be stated is a wise and safe one and cannot be too strictly followed. *Mere opportunity does not change an ordinary observer into an expert, and special skill does not entitle a witness to give an opinion when the subject is one where the opinion of an ordinary observer is admissible or where the jury are capable of forming their own conclusions from the pertinent facts susceptible of proof in common form.* (Jones' Commentaries on Evidence, Secs. 359, 360.) If it were possible in this case to determine whether or not the bullet in question was fired from the gun in question, it must have been by the peculiar rifling or condition of the gun that made what are called the peculiar markings on the bullet aforesaid. If any facts pertaining to the gun and its rifling existed by which such fact could be known, it would have been proper for the witness to have stated such facts and let the jury draw their own conclusions. Under the testimony of this witness, if allowable, the court would have had no alternative except to admit the gun in evidence if the proof had been positive that the bullet in question was the bullet cut out of Rahn's back by the physician. It is stated by Jones on Evidence in the sections above cited, that the general rule that facts, and not conclusions, should be stated tends to prevent fraud and perjury and is one of the strongest safeguards of personal liberty and private rights, and that whenever it is doubtful whether a case falls under the rule or under one of its exceptions, the wise course is to place it under the rule." It can readily be seen that the Supreme Court of Illinois in this opinion did not recognize the subject of ballistics as a science and that it was, therefore, of the opinion that the witness in question could have testified

to the facts pertaining to the gun and its rifling which would show that the bullet in question had been fired from the gun in question and that the jury should be left to draw their own conclusions from such facts. This opinion was filed on April 18, 1923. In *People v. Fiorita*, 339 Ill. 78, another case came before the Supreme Court of Illinois which involved the testimony of an alleged ballistic expert. Without discussing at this point the qualifications outlined by the witness in this case let us first consider his other testimony. The witness stated that by examining a bullet fired through a revolver he could tell the kind of revolver that propelled the bullet, that every revolver would make grooves and bands on the bullet which would have distinctive markings, that he had fired a test bullet through the gun introduced in evidence marked exhibit 3, being the gun taken from Nessor's and Fiorita's hotel room and that by comparison and examination of both bullets he was of the opinion that the bullet found in the body of Baltz, was fired from exhibit 3. The testimony of the witness was very extensive and elaborate but the court considered it unnecessary to recite further details because of the courts consideration that the witness did not possess such knowledge or experience as would qualify him as a ballistic expert. In its opinion, however, the court said, relative to ballistics being a science,

“While the science of ballistics is now a well recognized science both in this country and abroad, testimony based upon it should be admitted with the greatest care.”

After discussing again the qualifications of the witness in question the court continued as follows:

“Where previous study is essential to the formation of an opinion sought to be put in evidence, only such persons are competent to testify as experts as have by experience, special learning and training gained a knowledge of the subject matter upon which an opinion is to be given, superior to that of an ordinary person.” This opinion was filed February 21, 1930, approximately seven years after the opinion of the same court in the

case of *People v. Berkman*, *supra*. During this interim the attitude of the Supreme Court of Illinois toward ballistics as a science apparently had materially changed, for the court in the later opinion recognized ballistics as a science and also that a properly trained ballistic expert could in a proper case give his opinion as to whether or not a particular bullet had been fired from a particular gun and would not be limited to merely stating wherein the evidence bullet is similar to the experimental bullet. The altered attitude of the court toward the extent to which the expert could testify apparently arose through the recognition on its part that ballistics is a science. In *People v. Manke*, 78 N. Y. Rep. 611, the defendant was on trial for murder. On the trial it was proved that the person whom the defendant was charged with killing was shot, and near the place where the killing is alleged to have taken place was found some paper, which was claimed by the district attorney to have been the wadding with which the gun was loaded. This alleged wadding was produced at the trial and a witness, who stated that he had used firearms a great deal, and was familiar with the appearance of wadding shot from gun, was asked this question:

“You may answer whether that (the paper found as stated) had that appearance or not?”

This and the answer to it were objected to on the part of the prisoner, on the ground that the subject was not one of science or skill, and the opinion of the witness was incompetent and improper; that the paper and its appearance should be described and the jury should draw the inference. The court overruled the objection and allowed the witness, as far as he could, to state the facts as he observed them, and the prisoner excepted. The witness answered:

“Yes, sir; it had the appearance of being wadding shot from a gun;” and the only fact he stated was that it was burned. The General Term reversed the judgment and granted a new trial, holding that this exception was well taken. The court said “we concur generally in the opinion

there pronounced. We regard the question as a border one; and its competency is not free from doubt." While the facts in this case involve only a portion of shotgun wadding, nevertheless, shotgun wadding would include one phase of the subject of ballistics, and the court evidently thought that the subject was not one of science or skill and, therefore, that the opinion of the witness was incompetent and improper. In *Moughan v. The State, Supra*, the witness was allowed to express his opinion as to the length of time a particular gun had been discharged as were also the witnesses in *Meyers v. The State, Supra* and in *State v. Jones, Supra*, the court of Kansas held that the witness should have been permitted to give his opinion as to how far a gun would throw shot without scattering the same. In the last mentioned case the court recognized that the testimony was expert testimony and required special knowledge and skill in order to give the same, and in its opinion said, "In other words this is a question of science to be ascertained by study and experience and does not come within the common knowledge of men." In view of the foregoing decisions the test to be applied in determining whether or not the ballistic expert can give his opinion or merely relate the facts, and leave it to the jury to draw their conclusions therefrom, is whether or not the court recognizes that the facts testified to by the ballistic expert constitute matters of skill and science. If they do then the expert should be permitted to give his opinion, otherwise not.

In all of the foregoing cases the witnesses enter into more or less detail depending upon the circumstances in the particular case. This then leads to the fourth question viz: "whether or not the witness should be allowed to explain the basis of his opinion as by the use of a blackboard or the exhibition to the jury of the experimental shells, bullets, shotgun wadding, etc. In *Commonwealth v. Best, Supra*, the court held that a bullet of the same caliber as those found in decedents body and which some two weeks afterwards had been pushed through the rifle which, according to the state's contention was used to do the shooting, was not inadmissible

to show the similarity in marking on the ground that the force impelling the bullets was different, that the rifle barrel might be supposed to have been rusted more or less in the two weeks, and that it was fired three times two days after the homicide, which would have increased the leading of the barrel. In other words the experimental bullet was introduced in evidence in this case. It is worth noting however, that the objection was not made at the time, that the experimental bullet was not admissible because it was no part of the crime and was not used in the commission of the crime. Under the circumstances it is impossible to say what position the Supreme Court of Massachusetts would have taken had such an objection to its admissibility been made. The fact remains, however, that the experimental bullet was introduced in evidence and its introduction received the approval of the reviewing court. In *Johnson v. State*, 59 N. J. 535, 37 Atl. 949, certain witnesses testified to having seen certain footprints of a peculiar character in the dirt and soil near the body of the woman who had been murdered and for the purpose of showing that such footprints had been made by the defendant on trial, the state produced the boots that were worn by the prisoner on the night in question. Certain impressions in sand, made in the presence of the jury by the boots just mentioned, were exhibited to the jury against objections taken by counsel of the defendant. In passing on this exhibit the court said, "The testimony of the witnesses with regard to the appearance of these footprints was undoubtedly competent. Such testimony involved in no sense the knowledge of an expert, and the exhibition of the boots worn by the defendant on the night in question, and the impress in the sand by way of illustration with them were also competent." While in this case the court sanctioned exhibits in the presence of the jury it apparently did so upon the theory that the evidence in no sense involved the knowledge of an expert. The objection, to the admission in evidence of the experimental bullet or to a detailed demonstration in court as by the use of a blackboard or by comparing in

court the experimental bullet with the evidence bullet, has also been based upon the theory that such conduct on the part of the witness serves to place undue emphasis on his testimony. In the case of *People v. Jumpertz*, 21 Ill. 375 the attorney for the people brought into court the door of the room occupied by the defendant at the time of the alleged murder, and two hooks and a quantity of screws found in said room at the time of the arrest of the defendant. The prosecutor then proposed to make experiments on the door of the prisoner's room in the presence of the jury with a view to testing the probability of the deceased having hanged herself in the manner stated by the prisoner in his confession. Certain experiments were made with the door, both by the defendant and the state. In commenting on these experiments the court said, "Nor can we approve of the exhibition to the jury, during the recess of the court, of the door, screws, hooks, etc., or the experiments made with them in the presence of the jury during the trial. We will not say that in no case can experiments be made in the presence of the jury, for the purpose of illustrating some point in controversy. Such a proceeding, to say the least, is very uncommon, and should be permitted by the court with great caution. We will not say that, were this the only ground for reversing this judgment, that we would yield to it." The psychological effect of a demonstration of any kind in court is to improperly place undue emphasis on the evidence to which the demonstration pertains. However, as shown by the foregoing cases, the courts have indicated that experiments which serve to settle some points in controversy can properly be made in the presence of the jury. Therefore, it would seem proper to admit in evidence the experimental bullets and shotgun shells and also to permit the expert to explain by the use of a blackboard the basis of his conclusions if such experiment or demonstration in court will lead to the settlement of any point in controversy, provided the rights of the accused are guarded by proper instructions from the court, from any injury which might result to the accused from any undue emphasis being placed on the

testimony of the expert by the introduction of the experimental bullet or the use of the blackboard.

Inasmuch as the science of ballistics has of late undergone great development, it is highly desirable that the court look carefully into the qualifications of the witness before permitting him to testify. In *People v. Berkman, Supra*, the state sought to qualify the ballistic expert by having him testify that he had had charge of the inspection of firearms for the last five years of a police department; that he was a small arms inspector in the National Guard for a period of nine years, and that he was a sergeant in the service in the field artillery, where the pistol is the only weapon the men have, outside of the large guns or cannon. The court seemed inclined to the opinion that the testimony which the witness gave was absurd and commented upon the fact that there was no evidence in the case to show that the witness knew anything about how Colt automatic revolvers are made and how they are rifled, thereby leading one to believe that the court was of the opinion that this witness did not have sufficient qualifications to give the opinion which he was permitted to give on the trial in the lower court. In *People v. Fiorita, Supra*, the ballistic expert testified that he had been employed by the St. Louis police department since February, 1927, that for a few months preceding the date of the trial he had been the microscopic photographer and bullet examiner for the department; that his work consisted of identifying bullets as having been fired from certain weapons; that the work is done with a twin microscope with a single eye-piece; that he had been a photographer for fifteen or twenty years and at one time ran a shooting gallery and penny arcade; that this was his only experience with firearms until he became connected with the police department; that he had never been to or worked in a factory where guns were manufactured; that he thought the factory of the Colt company was at Hartford, Connecticut, but was not sure; that he did not know how guns looked when they first came from the machines; that he did not positively know whether the markings were the same on each

particular gun when they first came from the factory, although he had read considerable about Colt specifications; that he had never attended a school or college where the subject of ballistics is taught. In commenting on the testimony of this witness the court stated that "no witness should be permitted to testify regarding the identification of firearms and bullets by the use of this science unless the witness has clearly shown that he is qualified to give such testimony. In this case Lewis testified that he had been employed by the St. Louis police department and had been engaged in the identification of guns for several months; that he had never been to an arms manufacturing plant or seen guns in the process of manufacture; that he had never seen the tools with which the rifling is done; that he did not know how a gun looked when it first came from the machine; that his experience covered the examination of about 150 bullets. He made no attempt to state what educational qualifications he possessed, nor did he show that he had studied the works of recognized authorities in this science. He admitted, on cross-examination that he had never attended any school or college where the science of ballistics is taught. *The question of the qualification of an expert witness rests largely in the discretion of the trial court, and the test of qualification is necessarily a relative one, depending upon the subject under investigation and the fitness of the particular witness.* Where previous study is essential to the formation of an opinion sought to be put in evidence, only such persons are competent to testify as experts as have by experience, special learning and training gained a knowledge of the subject matter upon which an opinion is to be given, superior to that of an ordinary person. The experience and training of the witness Lewis, in this case, as shown by his testimony, were far from sufficient to qualify him as an expert, and it was an abuse of discretion for the trial court to admit his testimony."

The impossibility of laying down any hard and fast rule as to what qualifications a witness must possess in order to qualify as a ballistic expert is obvious. If, how-

ever, the trial courts will apply the reasoning outlined by the Supreme Court of Illinois in the last mentioned decision it should not be difficult to determine when a ballistic witness has the proper qualifications, the test being, is he possessed of a special learning and training through which he has gained a knowledge of the subject matter upon which an opinion is to be given which is superior to that of an ordinary person and has he demonstrated to the trial court that he has such ability, intelligence and training as will make his opinion reliable.

From the foregoing discussion it can readily be seen that there are many angles to consider in passing on the admissibility of ballistic evidence particularly where the expert is permitted to give his opinion as distinguished from the facts only upon which his opinion is based. Inasmuch as the defense has no opportunity to overcome the experts testimony except possibly by cross-examination there is an unusual opportunity for fraud which the courts will have to carefully guard against. Perhaps the most logical suggestion which has been made thus far is that the legislature pass a law providing for notice to the defendant when the tests are to be made by the expert, or in lieu thereof that the defense also be given an opportunity to make similar experiments.