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Final Summary Report
Research & Development in Forensic Science for Criminal Justice Purposes

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Project Title: Implications of Three-Dimensional Laser Scanned Images for the Criminal Justice System

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Purpose of the project

In recent years, there has been an increased focus on wrongful convictions and the reliability of presented evidence. Researchers at Columbia University (Liebman *et al,* 2000, 2002) demonstrated that a staggering 47% of capital wrongful convictions have been attributed to the presentation of unreliable evidence in court. In another study regarding forensic error, Gould *et al* (2012: 99) recommended that "more jurisdictions should have police officers trained in crime scene investigations who could be present when technicians are collecting evidence to help direct the collection and expand the area search," including documenting the crime scene. Reducing the number of wrongful convictions is an aim of the criminal justice system and the presentation of clear and reliable evidence to juries is a critical step in this direction.

Much information generated from evidence is made possible by reliable documentation of its position at a crime scene. Understandably, documentation techniques are influenced by available technologies. Technological advances and their associated reductions in price have allowed an increase in availability of 3D laser scanners to crime scene investigators (CSIs). Most CSIs do not have a background or formal training in surveying or metrology; however, modern day 3D laser scanners have become more portable, resistant to environmental elements, and able to be operated by individuals without a metrology background. As a result, 3D scanning has become increasingly popular, with more and more police agencies integrating 3D laser scanning into crime scene documentation protocols. However, the value of this new technology to the criminal justice system for documenting crime scenes, especially when compared to low-tech techniques is largely unknown. The overarching goal of the current project is to provide quantitative data on both laypeople's and forensic professionals' interpretation and assessment of traditional scene documentation methods compared to 3D laser scanned representations of mock crime scenes. In addition, a cost benefit analysis was conducted for four methods (3D laser scanner, photography, notes and scene sketches). Agencies can use these data to make training and budgetary decisions regarding the acquisition and utilization of 3D scanners while the criminal justice community can use this information regarding the use of 3D scanned representations in the courtroom. Put another way, we aimed to test if 3D scanned products

are worth the significant cost and time associated with the technology and training as related to the fact-finding mission that is ultimately presented to a jury.

Project Design and Methods

This research was divided into two phases. In Phase I, four indoor and eight outdoor mock crime scenes were staged and documented using four methods: a 3D laser scanner to produce 3D fly-through videos, a reflectorless total station to generate 2D topographic diagrams, a digital camera for 2D photographs, and traditional tape measure-based hand-drawn sketches. The mock scenes included human skeletal remains (outdoor) or a mannequin (indoor) and associated physical evidence. During the evaluation research component of this study (Phase II), we collected survey data on which of the four documentation methods most clearly depicted the mock crime scene and associated evidence.

Description of mock crime scenes

The eight outdoor scenes were documented over the course of two seasons (Spring/Summer and Fall/Winter) at the Anthropology Research Facility (ARF) managed by the Forensic Anthropology Center (FAC) at the University of Tennessee. The ARF is a three-acre outdoor natural environment dedicated to the study of human decomposition. The outdoor scenes consisted of two seasonal scenarios each of 1) fresh or proxy remains on the ground (not buried); 2) skeletal remains on the ground and not buried; 3) skeletal remains in a shallow burial (less than one meter); and 4) skeletal remains in a deep burial (> 1.5 meters). The outdoor mock scenes represented the variation experienced in FAC casework, including scattered remains and commingled individuals, while incorporating seasonal variation in foliage and leaf litter. The four indoor scenes mimicked death scenes in a bathroom, a crawlspace, an office, and a hotel room. A mannequin was used to limit biohazard concerns while still representing a human figure. See Table 1.

Images of all scenes were produced using four methods: 3D fly-through videos were created using a FARO Focus3D X330 3D laser scanner; digital photographs were captured using a Nikon D7100 digital

single lens reflex (D-SLR) camera; 2D topographic diagrams were created using a reflectorless total station and CAD software (Leica DTM752R and the ArcGIS software package); and hand drawn sketches were created using tape measures, string and graph paper and writing instruments. Both indoor and outdoor scenes were laser scanned prior to other documentation to not disturb any evidence. Photographic coverage included overall, mid-range, and close-up images to capture the spatial and contextual relationship of evidence within the outdoor or indoor scene. A hand-drawn map was generated based on the commonly

Table 1. A summary of mock scenes, their location, and their inclusion in surveys 1 and/or survey 2.

Season	Location	Scene type	Survey inclusion
Spring	Indoor	Hotel Room	Survey 1: 4 way comparison; Survey 2: 2D map
Spring	Indoor	Office	No
Fall	Indoor	Bathroom	No
Fall	Indoor	Crawl space	Survey 1: Photographs
Spring	Outdoor	Fresh Surface remains	No
Spring	Outdoor	Skeletonized scattered	Survey 1: 2D; Survey 2: 4-way comparison
Spring	Outdoor	Shallow burial	Survey 2: 4-way comparison
Spring	Outdoor	Deep burial	Survey 1: 4 way comparison
Fall	Outdoor	Fresh Surface remains	No
Fall	Outdoor	Skeletonized commingled	Survey 2: hand drawn
Fall	Outdoor	Shallow burial	Survey 1: 3D; Survey2: photographs
Fall	Outdoor	Deep burial	Survey 1: hand drawn; Survey 2: 3D

employed grid system wherein a reference point and baseline were established and a grid was constructed. Measurements were taken from a reference point (datum) to precisely map in all evidentiary objects of interest. The datum and grid were georeferenced with a survey-grade GPS unit (Trimble Geo XH 6000 series and an RTK). For indoor scenes, the trilateration method was utilized with measurements for each item of evidence and major features on the body taken from two fixed reference points within the scene. See Appendix A for some scene depictions included in survey. For all scenes and methods, the total time spent collecting, processing the data and producing the videos, images and maps was recorded.

Description of Survey

A stratified random sample of laypeople and various members of the law enforcement community were presented with renderings of the mock crime scenes and surveyed to assess which representation

(photographs, 3D, hand drawn, or 2D) most accurately conveyed visual and spatial information about a given scene, i.e. which best depicted the physical evidence and body position/placement in the scene. Survey participants were presented with all documentation methods to reveal any potential biases, limitations, and advantages of 3D products compared to the three other documentation methods. Two variations of the survey were used which allowed more scenes to be used while keeping the survey completion time at 30 minutes. Not all scenes were included in the surveys. The survey pool included University students, local volunteers, and law enforcement agents; the former representative of jurors while the latter are more knowledgeable about scene work. Respondents were informed the images were of mock crime scenes, but they were not provided any additional information.

The survey consisted of: 1) Biographical information; 2) Questions about what was seen in each image e.g. body position, evidence, and personal effects; 3) A 4-way comparison of all depictions for the same scene; and 4) opinion questions. See Appendix B for complete survey.

Data Analysis

Basic descriptive statistics were tabulated by age cohort, sex, and profession. Data were analyzed as a group (pooled) and also separated by demographic categories to examine general trends as well as the influence of age, sex, and profession on perceived effectiveness of each scene representation. An "accuracy" score was calculated for each of the scenes in Section 2 of the survey.

Project Findings

Demographics

A total of 461 people took the surveys: 243 and 218 for 1 and 2, respectively. Demographic information is available in Tables 2-4. The number of law enforcement participants is consistent across both surveys while more retired (or over 60) individuals completed the first survey and more students completed

the second survey. Veterinarian, administrative assistant, dentist, property manager, salesperson, and chaplain are examples of "other".

Table 2. Survey 1 and 2 employment demographics

Employment	Survey 1	Survey 2	Total	Percentage
Law Enforcement	87	90	177	38.5
Retired	53	19	72	15.4
Student	63	90	153	33.3
Faculty	6	5	11	2.4
Other	34	14	48	10.4
Total	243	218	461	100.0

When considered by age, most participants are in the 18-30 cohort (38.4%) with 27.8% in the 31-45 age group and the remaining two groups approximately equal at ~17%.

Table 3. Survey 1 and 2 sex demographics

Sex	Survey 1	Survey 2	Total	Percentage
Male	101	92	193	41.9
Female	141	125	266	57.7
No answer	1	1	2	0.4
Total	243	218	461	100

Table 4. Survey 1 and 2 age demographics

Age group	Survey 1	Survey 2	Total	Percentage
18-30	79	98	177	38.4
31-45	67	61	128	27.8
46-60	40	39	79	17.1
60+	57	20	77	16.7
Total	243	218	461	100

Accuracy Scores

The accuracy score was based on the correct observation of the evidence depicted in each scene image. While examining a scene image, respondents answered questions about the scene (see Appendix B, Survey section 2). If the number of individuals, how they were positioned, what evidence was present, and where they were placed were correctly observed, they received a score of 100%.   Each incorrect response decreased the accuracy score. The viewpoints chosen in the 3D video and photographs were general in nature to show the overall scene and were not focused on any specific areas or evidence. The average accuracy scores for each scene surveyed are presented in Table 5.

Indoor scenes had higher average accuracy values underscoring the difficulty in capturing and interpreting outdoor scenes. When only outdoor scenes are considered, 3D representations scored lower than photographs and 2D topographic diagrams. While comparing the results of Survey 1 and Survey 2 is problematic because of the different test-taking population, it does provide insight in overall trends of how evidence is interpreted.

Table 5. Average Accuracy Score for each Scene

Method	Scene	Average Score
Photo	Indoor Crawlspace	87
2D Map	Indoor Hotel	75
2D Map	Surface Scatter	73
Photo	Shallow burial	68
3D	Shallow burial	61
3D	Deep burial	61
Hand drawn	Surface Scatter	55
Hand drawn	Deep Burial	35

Figures C1-C4 (Appendix C) illustrate the overall distribution of accuracy scores. The difference in scores between Surveys 1 and 2 among all methods may be due to the type of scene. For example, in both surveys, the results for 2D maps plateaued above 50% accuracy (Fig. C2), however, in Survey 2, there were multiple scores of 100% where as there were no scores above 90% in Survey 1. The difference in score distribution may be due to easier interpretation of non-skeletal remains in an indoor scene (Survey 2) versus scattered outdoor surface remains (Survey 1)- see Figures A1a and A2a, Appendix A. The 3D scans display a normal distribution showing few scores below 50% accuracy and most scores between 60-70%. While 3D have higher scores than hand drawn products, photographs are superior in terms of overall accuracy as judged by the survey.

Preferred methods

3D videos were the preferred documentation method (67.8%) with 23.4% identifying photographs as the preferred method (Table 6). Many respondents indicated that the 3D video brought the "scene to life", provided the most context, and allowed better understanding of the surroundings (Appendix D). Roughly half of the respondents ranked photographs as the second preferred method (50.2% of respondents, n=110) (Table 7).

Table 6. Preferred method

Method	Frequency	Percent
3D videos	287	67.8
Photographs	99	23.4
All methods	14	3.3
2D	13	3.1
Hand drawn	10	2.4
Total	423	100.0

Table 7. Second preferred method

Method	Frequency	Percent
Photographs	110	50.2
3D videos	57	6.0
2D	34	15.5
Hand drawn	18	8.2
Total	219	100.0

Despite the preference in documentation method, our data show 3D images are not interpreted as accurately as photographs. In addition, photographs seem to be *trusted* more than 3D maps as reflected in comments (Appendix D): "3D is excellent and provides more detail, however the authenticity of a photograph cannot be challenged or duplicated" (Law enforcement); "Photographs cannot be manipulated or altered as compared to a digital product based on computer program. Plus they capture the scene immediately after the crime" (Law enforcement). "The 3D rendering offers the opportunity for changing the image since it is computer generated. How can I be assured that is connected to the "real" evidence?" (Retired); "3D rendering gives the most detail but I wouldn't understand how the data is manipulated to make the 3D image" (Student). Despite the lack of understanding of how 3D videos are produced, 80% of survey respondents either strongly agree or agree that 3D scans should be included in jury presentations (Appendix C, Table 1),

Cost benefit analysis

Another aspect of this research is to provide a cost benefits analysis for all documentation methods. Costs include training, operation, and equipment purchase expenses. The numbers presented for 3D and 2D equipment reflects the cost for the models used in this research and include necessary equipment to process the data such as computers and software. The cost associated with photography and hand-drawn maps reflect the equipment bought with this current grant's budget.

A typical 3D laser scanner operator will attend a three-day certification course. Advanced training is available for agencies who wish to record more complex scene data (i.e. shooting trajectory analysis, bloodstain pattern analysis). The manufacturer certification training can range from no cost (is included in the purchase price) up to $2,000 to $3,000 per operator. While 3D laser scanners have decreased in price over the past five years, a medium-range terrestrial 3D laser scanner suitable for crime scene work, range in cost from $15,000 up to $120,000, depending on range, accuracy, speed, and durability. Associated equipment such as targets, tripods, software and a high-end gaming laptop to process the data can add $5,000 to $10,000. Operational costs including annual calibration, maintenance and warranty packages add an additional $3,000 to $8,000 per year.

The production of 3D images requires equipment set up, scanning, and post-processing as the scan data must be transferred to a computer and registered (stitched together) by software, cleaned up and 3D videos or other deliverables generated for eventual presentation in the courtroom. For each scene in this research, the average time for scanning, post-processing, and production of the 3D fly through was 81 minutes.

Table 8. Time-Cost Benefit Analysis.

Methods	Avg. Training cost	Avg. Equipment cost	Avg. time to final product	Cost per minute*
3D scan	$2,500	$69,000	81 minutes	$852
Total station	$2,500	$28,000	94 minutes	$297
Photography	$2,500	$882	7 minutes	$126
Hand-drawn	$1,000	$52	66 minutes	$0.79

* The Cost per minute=Equipment Cost/Avg time to final product

Training to operate, collect data and process the subsequent data from a total station are on par with, if not more expensive than laser scanner operator training program. Total station prices range from $4,000 to $50,000 for the equipment though software and computer costs increased expenditures. The equipment used here cost approximately $28,000 including software (ArcGis and Faro2D). In this research, the average time for two people to collect data points was 49 minutes per scene. Another individual created a 2D topographic diagram from the data points averaging 45 minutes for each scene bringing the total to 94 minutes.

Photography is often a module in basic academy curriculum although agencies send crime scene investigators to outside vendors for initial or advanced training (e.g. arson scenes). Most digital photography training ranges from 40 to 80 hours with costs compatible with the shorter laser scanning certification courses. Digital photography equipment has also become much more affordable over the past two decades and range in cost from $200 for a low-end point-and-shoot camera to over $3,000 for a higher-end digital single lens reflex camera body. The addition of interchangeable lenses, external lighting and tripods increases the cost as well, depending upon the complexity of the photography kit. Most crime scene photographers operate with a prosumer-level D-SLR camera, a zoom lens, external flash and tripod, with an average cost of $1,000-$5,000 for the entire kit. The setup used in this research cost $882. The average time for one person to take the scene photographs was seven minutes.

Hand drawn scene maps have a low equipment cost but effective sketches, particularly for specialized circumstances such as clandestine grave recovery and documentation require advanced training over basic academy coursework. Crime scene documentation or advanced mapping courses can cost up to $1000/person although these courses often include other subjects (i.e. Entomology, Odontology). The supplies to produce hand drawn maps includes string, tape measures, writing instruments and graph paper; all for a cost of less than $100. For this research, the time for two people to produce a hand drawn sketch averaged 66 minutes per scene.

The cost benefit analysis provides a unique set of data regarding the four methods of scene documentation. The hand drawn maps are the most affordable, with average costs of less than one dollar per minute of work yet only 2.4% of respondents chose this as their preferred method. The 2D topographic diagrams had an average accuracy score over 70% and has a cost of approximately $300 per minute but only 3.1% selected it as the preferred method. While 67.8% of respondents identified 3D scans as their preferred method, the cost per minute for this method exceeds $800. Almost one quarter of all respondents (23.4%) identified photography as their preferred method and the cost for this method is slightly over $100 per minute of work. In addition, the average accuracy scores for photographs were also higher than for 3D scans.

Photography and 3D scans are the best in terms of preference yet the costs associated with the two methods differ greatly.

Research Limitations

The survey takers were not provided any explanation of the 3D or total station technology; therefore the participants' uncertainty about the technology, particularly 3D scanners, may not reflect a *jury member's* uncertainty as the expert witness would have the opportunity to explain the technology. In addition, during the survey, the 3D fly-throughs were not paused so to not conflate photography and 3D results. Finally, this survey did not focus on the importance of metrics. Measurement data captured by the laser scanner will allow for the provenience of that item to be measured long after the scene examination concluded and those measurements will be much more accurate (as accurate as 1mm) than those taken with a tape measure, the typical accuracy standard of which is ¼ inch.

Conclusion

Overwhelmingly, 3D videos were the preferred documentation method with photographs being the second most preferred, however 2D diagrams and photographs had the highest average accuracies concerning scene interpretation. While 3D products were preferred, they come with the most significant costs in terms of training, equipment, and resources and there were several caveats noted by respondents about their faith in the presentation of this data. There are clear advantages to recording a scene precisely in three-dimensions--it allows for any individual, be it an investigator, expert witness, attorney, judge or jury member, to return to the crime scene and examine the scene *in situ* with extremely precisely documented spatial relationships. Essentially, potential jurors prefer 3D products, but they express uncertainty in how they are produced and whether the data can be manipulated in a way that disrupts the fact-finding mission. These data suggest that without proper explanations of 3D scan technology, the policies and procedures required to create a 3D video, and an explanation of the verifiable accuracy of the data, a jury may not *trust*

a 3D video. As such, these opinions imply that while law enforcement appreciate the capabilities of the tool, any testimony must include an overview of how the 3D scanning works, how the data are collected, and all of the steps that have been performed to produce the final product.

Photography is the second most preferred documentation method, demonstrates high accuracy in interpretation, is easy to implement in practice, and is relatively cheap in terms of equipment and training. Further, everyone has first-hand experience with photographs and so they understand and trust them. An added benefit to this method is viewers get to view the crime scene for themselves and the product is familiar unlike those resulting from hand drawn maps or computer generated 2D diagrams. While the hand drawn and 2D products were not as preferable, the former is cheap and easy to implement with little resource investment (the high cost of the 2D makes it not ideal). Survey respondents consider hand-drawn depictions more ambiguous and harder to interpret than photographs, 2D drawings, or 3D renderings.

In sum, photographic evidence is undeniably superior in terms of its cost benefit. It is affordable and allows for more accurate interpretations in a variety of contexts. However, if 3D scanning is feasible given an agency's budget and needs, the documentation is unparalleled in terms of precision regarding spatial locations and relationships. In addition, a laser scanner will document everything within line of sight of the laser scanner, 360 degrees horizontally around the scanner and ~300 degrees vertically around the scanner. Digital pictures suffer from bias as they require the photographer to choose the subject, object, scene or landscape, and while agency protocols can require a series of photographs be taken, there is still concern that not all was photographed.

Implications on the Criminal Justice System

The target audience for this project includes laypeople, representing a diverse jury population, as well as varying members of the criminal justice system, including investigators, attorneys, and judges. Although our main purpose is to understand how laypeople interpret 3D data, all visual evidence was examined in order to improve understanding of the limitations and strengths of 3D visuals compared to other

documentation methods. This research provides NIJ and the criminal justice system with knowledge on which visual aids are found to provide the most informative, fair and accurate representation of the scene. Although photography and 3D vary slightly on these attributes, there is a large disparity in operational expenses with photography having a 8 to 1 advantage in cost. In addition, attorneys must realize the implications of newer 3D visual aids and how they contribute to juror understanding of the scene and, ultimately, the case. Judges will be made aware of the confidence that can be placed in 3D products, as well as how they are interpreted. Lastly, law enforcement will be informed on the potential benefits of 3D scanned products, as well as best practice at incorporating multiple products, to always include photography, that fits their budgetary constraints.

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http://www2.law.columbia.edu/brokensystem2/report.pdf

APPENDIX A. Scene Depictions

These are examples of some of the scene depictions deployed in the survey. Not all scene depictions are presented. 3D videos are not included.
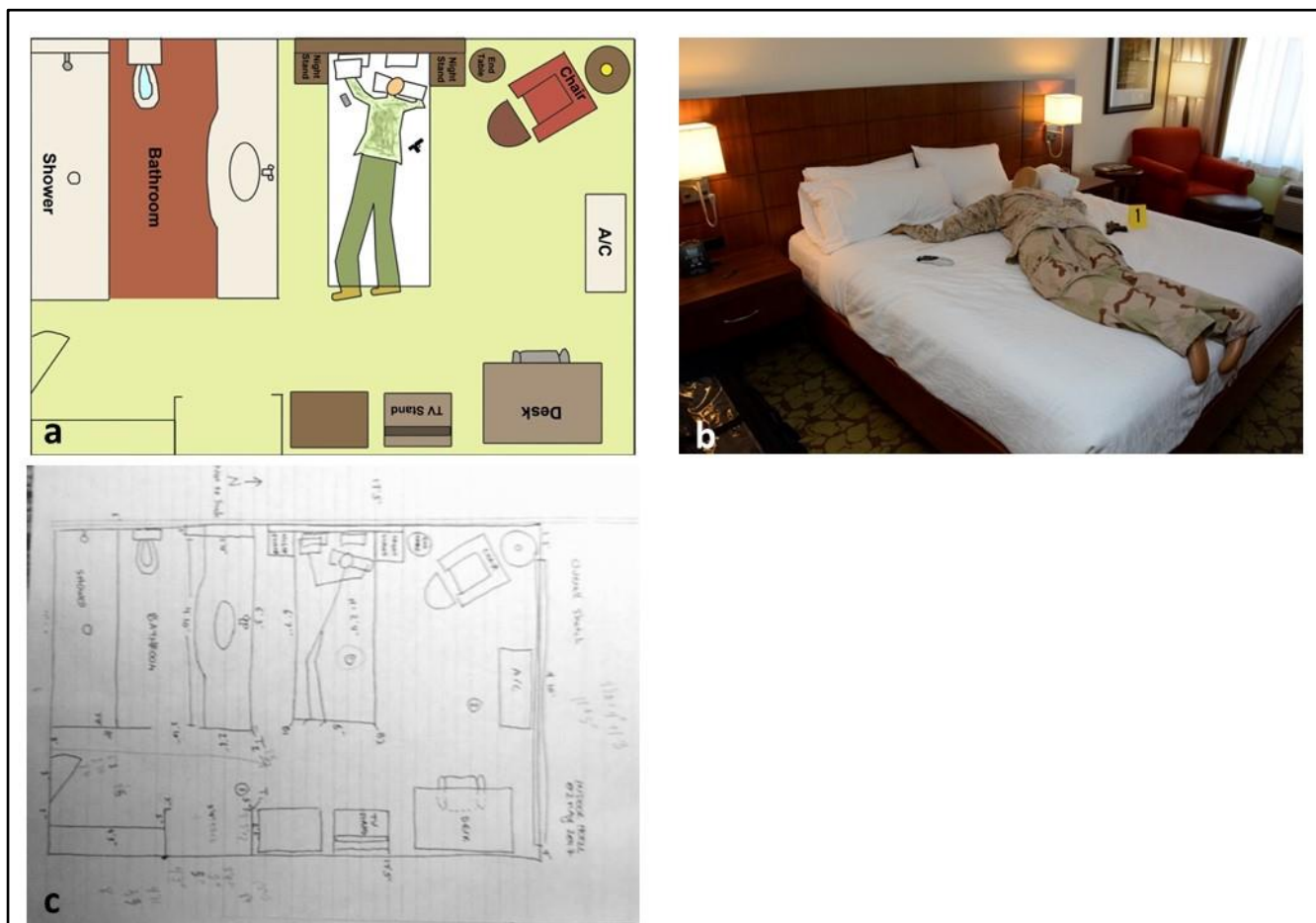

Figure A1. Depictions of hotel room scene: a. 2D map; b. photograph; c. hand drawing
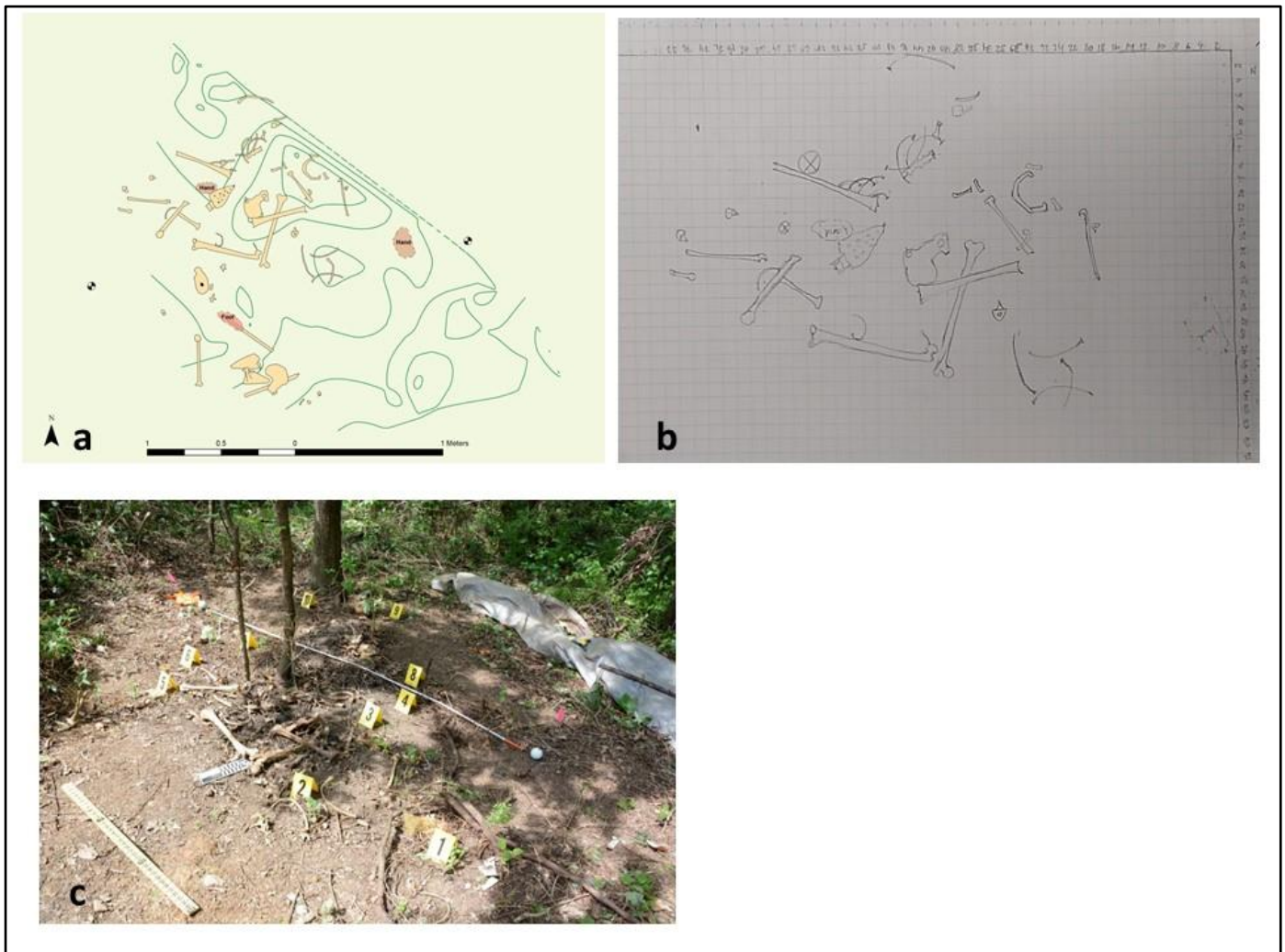
Figure A2. Depictions of outdoor surface scatter: a.2D map; b. hand drawing; c. photograph
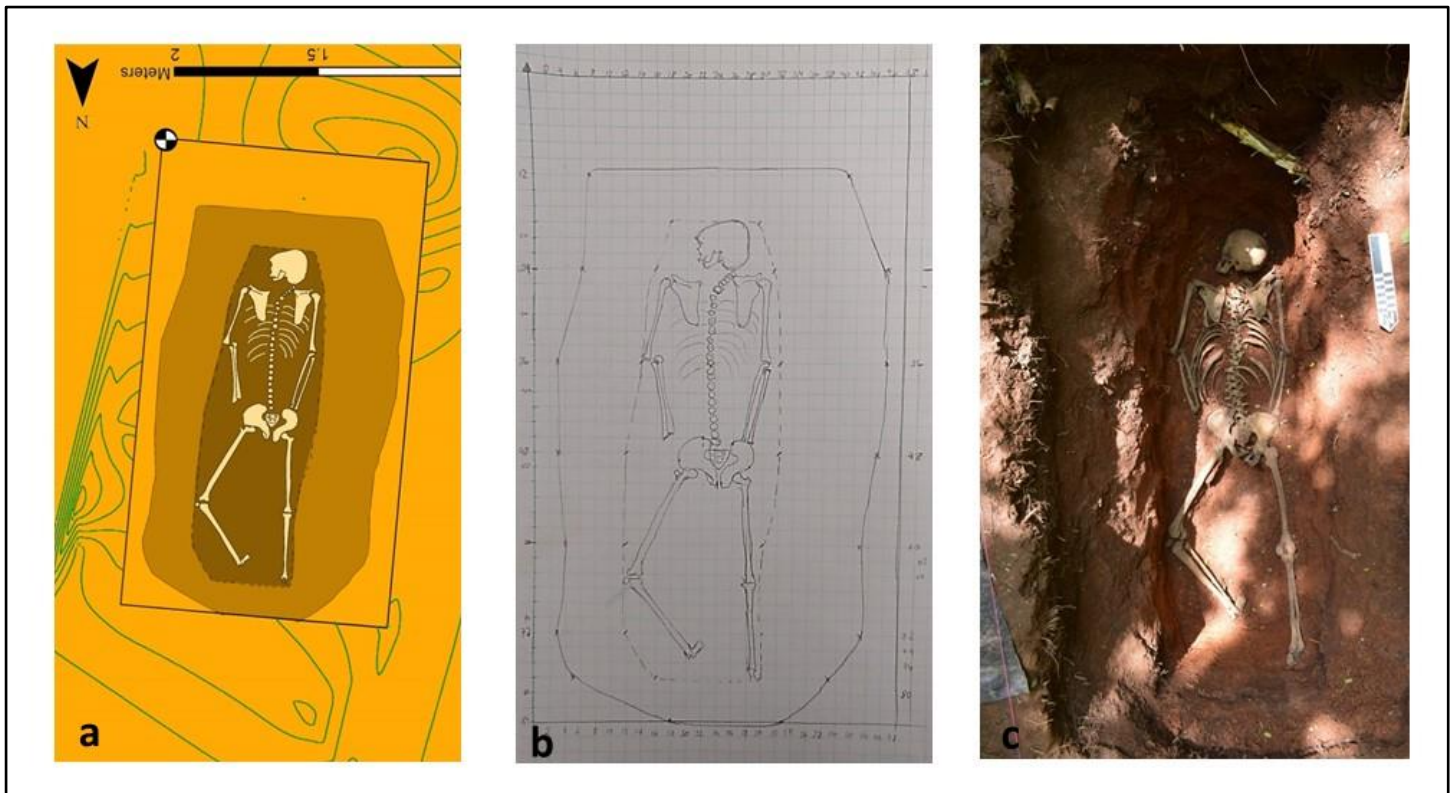
Figure A3. Depictions of a deep burial: a. 2D map; b. hand drawing; c. photograph
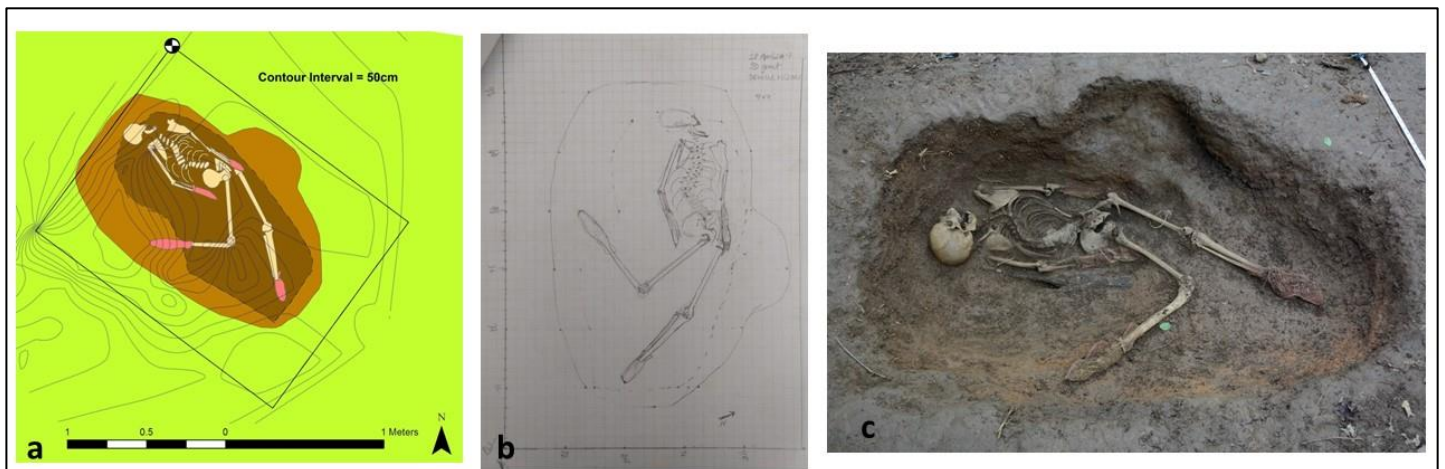

Figure A4. Depictions of a shallow burial: a. 2D map; b. hand drawing; c. photograph

APPENDIX B. SURVEY of Implications of Three-Dimensional Laser Scanned Images for the Criminal Justice System

You are participating in a study that will evaluate the effectiveness of different documentation methods of recovery scenes. The goal of this National Institute of Justice (NIJ)-sponsored project is to provide data to the criminal justice system on how well the documentation methods represent the mock crime scene.

- *Section 1 consists of 11 questions that are basic in nature*
- *Section 2 consists of a series (4) of projected images and four corresponding questions for each image. Section 2 begins on Page 3.*
- *Section 3 consists of a collage of images and five corresponding questions for each collage.*
- *Section 4 consists of five questions and no associated images.*
- *For each intended response merely mark the adjacent circle.*
    - *Some questions allow a single response,*
    - *Other questions have the option of multiple responses*

Please begin section 1. Upon completion await display of the first projected image.

Question 1 Your current employment position:

○ Law Enforcement, Crime Scene Technician, or related field

○ Retired   *skip to Question 7 if you select this option*

○ Student   *skip to Question 4 if you select this option*

○ Faculty   *skip to Question 5 if you select this option*

○ Other   *skip to Question 6 if you select this option*

Question 2 How many years have you been in this line of work?

○ Less than 5 years

○ 5 – 15 years

○ More than 15 years

Question 3 How many crime scenes have you processed?

○ Less than 10

○ 10-30

○ 30-50

○ More than 50

Question 4 What is your major? _____

Question 5 In what Department do you teach? _____

Question 6 Describe "Other" _____
_____

Question 7 Have you served on a jury?

○ Yes

○ No

Question 8 Have you testified as an expert witness in court?

○ Yes

○ No

Question 9 How comfortable are you with new technology?

○ Extremely comfortable

○ Moderately comfortable

○ Slightly comfortable

○ Neither comfortable no uncomfortable

○ Slightly uncomfortable

○ Moderately uncomfortable

○ Extremely uncomfortable

Question 10 What is your sex?

○ Male

○ Female

○ I prefer not to answer

Question 11 What is your age range

○ 18-22

○ 23-30

○ 31-45

○ 46-60

○ More than 60

Section 2
Please view the first projected image and answer the following questions.

Question 12 How many individuals do you see represented?

○ 1

○ 2

○ I am not sure

○ More than 2

Question 13 How is/are the individual(s) placed?

○ On their back

○ On their stomach

○ On their side

○ The remains are scattered

○ I cannot tell

Question 14 How is the body positioned? *Select all that apply.*

○ With one arm bent at the elbow   ○ With both arms bent at the elbow

○ With a leg bent at the knee   ○ With both legs bent at the knee

○ With both arms straight out   ○ With both legs straight out

○ The remains are scattered

Question 15 What evidence do you see in the image? *Select all that apply.*

○ A baseball hat   ○ A wallet

○ A bullet casing   ○ A gun/rifle

○ A cigarette butt   ○ A knife

○ A footprint   ○ A dish glove

○ Clothing   ○ A metal rod

○ A bottle   ○ I see evidence but I am not sure what
                                        it is

○ I don't see any evidence

Question 16 The remains are:

○ In a deep grave/pit

○ In a shallow grave/pit

○ In a grave/pit but not sure if deep or shallow

○ Outdoors on the ground surface

○ Indoors

○ I cannot tell

Question 17 How confident do you feel about your answers?

○ A great deal

○ A lot

○ A moderate amount

○ A little

○ None at all

Section 2
Please view the second projected image and answer the following questions.

Question 18 How many individuals do you see represented?

○ 1

○ 2

○ I am not sure

○ More than 2

Question 19 How is/are the individual(s) placed?

○ On their back

○ On their stomach

○ On their side

○ The remains are scattered

○ I cannot tell

Question 20 How is the body positioned? *Select all that apply.*

○ With one arm bent at the elbow   ○ With both arms bent at the elbow

○ With a leg bent at the knee   ○ With both legs bent at the knee

○ With both arms straight out   ○ With both legs straight out

○ The remains are scattered

Question 21 What evidence do you see in the image? *Select all that apply.*

○ A baseball hat   ○ A wallet

○ A bullet casing   ○ A gun/rifle

○ A cigarette butt   ○ A knife

○ A footprint   ○ A dish glove

○ Clothing   ○ A metal rod

○ A bottle   ○ I see evidence but I am not sure what
                                      it is

○ I don't see any evidence

Question 22 The remains are:

○ In a deep grave/pit

○ In a shallow grave/pit

○ In a grave/pit but not sure if deep or shallow

○ Outdoors on the ground surface

○ Indoors

○ I cannot tell

Question 23 How confident do you feel about your answers?

○ A great deal

○ A lot

○ A moderate amount

○ A little

○ None at all

Section 2
Please view the third projected image and answer the following questions.

Question 24 How many individuals do you see represented?

○ 1

○ 2

○ I am not sure

○ More than 2

Question 25 How is/are the individual(s) placed?

○ On their back

○ On their stomach

○ On their side

○ The remains are scattered

○ I cannot tell

Question 26 How is the body positioned? *Select all that apply.*

○ With one arm bent at the elbow   ○ With both arms bent at the elbow

○ With a leg bent at the knee   ○ With both legs bent at the knee

○ With both arms straight out   ○ With both legs straight out

○ The remains are scattered

Question 27 What evidence do you see in the image? *Select all that apply.*

○ A baseball hat   ○ A wallet

○ A bullet casing   ○ A gun/rifle

○ A cigarette butt   ○ A knife

○ A footprint   ○ A dish glove

○ Clothing   ○ A metal rod

○ A bottle   ○ I see evidence but I am not sure what it is

○ I don't see any evidence

Question 28 The remains are:

○ In a deep grave/pit

○ In a shallow grave/pit

○ In a grave/pit but not sure if deep or shallow

○ Outdoors on the ground surface

○ Indoors

○ I cannot tell

Question 29 How confident do you feel about your answers?

○ A great deal

○ A lot

○ A moderate amount

○ A little

○ None at all

Section 2
Please view the fourth projected image and answer the following questions.

Question 30 How many individuals do you see represented?

◯ 1

◯ 2

◯ I am not sure

◯ More than 2

Question 31 How is/are the individual(s) placed?

◯ On their back

◯ On their stomach

◯ On their side

◯ The remains are scattered

◯ I cannot tell

Question 32 How is the body positioned? *Select all that apply.*

◯ With one arm bent at the elbow   ◯ With both arms bent at the elbow

◯ With a leg bent at the knee   ◯ With both legs bent at the knee

◯ With both arms straight out   ◯ With both legs straight out

◯ The remains are scattered

Question 33 What evidence do you see in the image? *Select all that apply.*

○ A baseball hat   ○ A wallet

○ A bullet casing   ○ A gun/rifle

○ A cigarette butt   ○ A knife

○ A footprint   ○ A dish glove

○ Clothing   ○ A metal rod

○ A bottle   ○ I see evidence but I am not sure what
                                           it is

○ I don't see any evidence

Question 34 The remains are:

○ In a deep grave/pit

○ In a shallow grave/pit

○ In a grave/pit but not sure if deep or shallow

○ Outdoors on the ground surface

○ Indoors

○ I cannot tell

Question 35 How confident do you feel about your answers?

○ A great deal

○ A lot

○ A moderate amount

○ A little

○ None at all

Section 3

Please view the first projected collage image and answer the following questions.

Question 36 Image A gives me as much information as Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 37 Image B gives me as much information as Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 38 Image C gives me as much information as Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 39 I trust Image A to base my opinion on the crime scene context more than Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 40 I trust Image B to base my opinion on the crime scene context more than Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 41 I trust Image C to base my opinion on the crime scene context more than Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree   ○ Strongly disagree

Section 3
Please view the second projected collage image and answer the following questions.

Question 42 Image A gives me as much information as Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 43 Image B gives me as much information as Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 44 Image C gives me as much information as Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree   ○   Strongly Disagree

Question 45 I trust Image A to base my opinion on the crime scene context more than Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 46 I trust Image B to base my opinion on the crime scene context more than Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 47 I trust Image C to base my opinion on the crime scene context more than Image D.

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree   ○ Strongly Disagree

Section 4
This survey is interested in the effect of 3D crime scene representation in court. Please answer the following questions in regards to the overall effect of the 3D portrayals of the mock crime scenes.

Question 48 I think 3D maps should be included in the presentation of evidence to the jury.

   ◯ Strongly agree

   ◯ Agree

   ◯ Somewhat agree

   ◯ Neither agree nor disagree

   ◯ Somewhat disagree

   ◯ Disagree

   ◯ Strongly disagree

Question 49 I think 3D maps *do not* add to the contextual information of the crime scene and are unnecessary.

   ◯ Strongly agree

   ◯ Agree

   ◯ Somewhat agree

   ◯ Neither agree nor disagree

   ◯ Somewhat disagree

   ◯ Disagree

   ◯ Strongly disagree

Question 50 I put more faith in the 3D maps than other crime scene images (hand drawn maps, photographs, or 2D images).

○ Strongly agree

○ Agree

○ Somewhat agree

○ Neither agree nor disagree

○ Somewhat disagree

○ Disagree

○ Strongly disagree

Question 51 Which documentation technique best demonstrated a fair representation of the scene?

○ Hand drawn maps

○ 2D images

○ Photographs

○ 3D renderings

Question 52 Which of the four documentation methods (hand drawn maps, 2D images, photographs, or 3D renderings) do you prefer and why?

_____

_____

Question 53 Which of the four documentation methods is your second preferred?

○ Hand drawn maps

○ 2D images

○ Photographs

○ 3D renderings

END OF SURVEY

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APPENDIX C. Additional Survey Results

Table C1. Answers to survey question #48

I think 3D maps should be included in the presentation of evidence to the jury.		
Answer	**Frequency**	**Percent**
Strongly Agree	220	48.7
Agree	173	38.3
Somewhat agree	47	10.4
Neither agree nor disagree	11	2.4
Somewhat disagree	1	0.2
Disagree	0	0
Strongly disagree	0	0
Total	452	100.0

Table C2. Answers to survey question #49

I think 3D maps do not add to the contextual information of the crime scene and are unnecessary		
Answer	**Frequency**	**Percent**
Strongly Agree	2	0.4
Agree	5	1.1
Somewhat agree	16	3.5
Neither agree nor disagree	16	3.5
Somewhat disagree	75	16.6
Disagree	192	42.4
Strongly disagree	147	32.5
Total	452	100.0

Table C3. Answers to survey question #50

I put more faith in 3D maps than other crime scene images		
Answer	**Frequency**	**Percent**
Strongly Agree	72	15.9
Agree	104	23.0
Somewhat agree	95	21.0
Neither agree nor disagree	88	19.5
Somewhat disagree	53	11.7
Disagree	36	8.0
Strongly disagree	4	0.9
Total	452	100.0

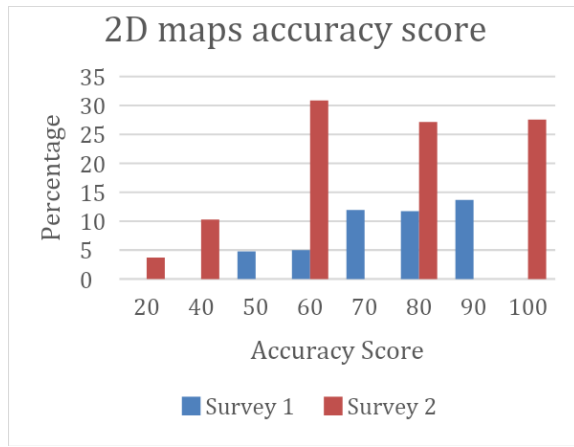2016-DN-BX-0177 Final Summary Report
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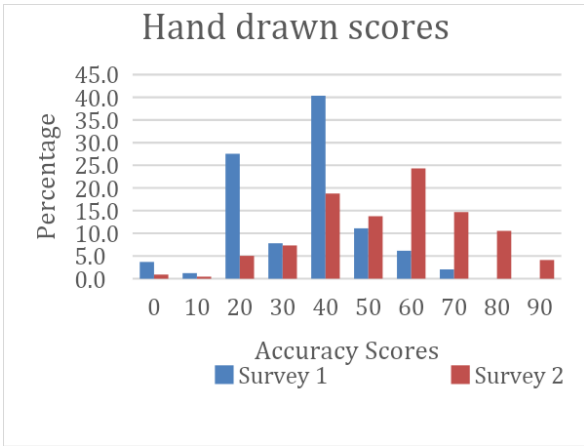
Figure C1 (left). Hand drawn map accuracy scores. Survey 1 (deep burial) and Survey 2 (surface scatter).

Figure C2 (right). 2D topographic diagrams accuracy scores for Survey 1 (surface scatter) and Survey 2 (indoor hotel).
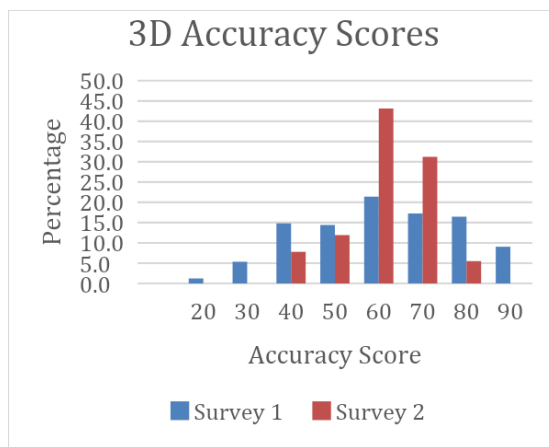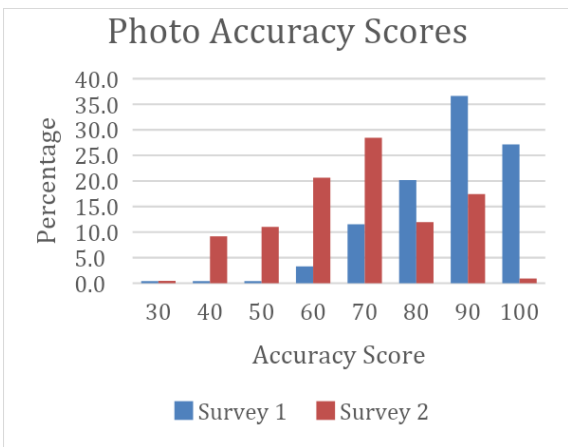

Figure C3 (left). Photograph accuracy scores Survey 1 (indoor crawl space) and Survey 2 (shallow burial).

Figure C4 (right). 3D accuracy scores Survey 1 (shallow burial) and Survey 2 (deep burial).

APPENDIX D. Survey Comments

Survey Comments to Question #52: "Which of the four documentation methods (hand drawn maps, 2D images, photographs, or 3D renderings) do you prefer and why?"

Faculty   3D - gives more depth, more detail and several angles of scene.

Faculty   3D because it captures all parts of the crime scene at different angles where as the other methods do not. The 3D method doesn't leave room for people to imagine or fill in what is originally missing because the whole scene is given.

Faculty   3D of hotel/room gave me more evidence i.e. inside bathroom, television show watched, carpet next to bed, windows etc. For the outdoor grave sites; 3D was good but I felt like I could get as much out of the photographs.

Faculty   3D renderings as they are more realistic and insightful regarding the accuracy of what is present at the scene.

Faculty   I prefer the 3D renderings, but also think sometimes including 2D maps/photos that make some of the individual remains pop out is also helpful. Perhaps a system that could be used to highlight scattered surface remains so they are clearly visible to a lay-person would be helpful as well.

Faculty   I would like the combination of hand drawn maps and 3D renderings - not only one source.

Faculty   It is difficult to say, hand drawn provides a nice bird's eye view overall, but I feel that a jury might find a 3D rendering easier to visualize, so for me hand drawn, for juries 3D rendering.

Faculty   Photographs, clearer depiction of the crime scene.

Faculty   photos, allow you to be present

Law Enforcement   3D - adds most context to scene

Law Enforcement   3D better detail. The ability to view the scene 360 degrees.

Law Enforcement   3D I feel it gives an overall contextual view of the crime scene. The only draw back is the ability to see distance of evidence.

Law Enforcement   3D- it gave the whole picture.

Law Enforcement   Hand drawn maps gives a visual perspective of a person that has witnessed the actual scene.

Law Enforcement   hand drawn maps because you can add information like measurements to it. You can also document everything on a map that a video may miss.

Law Enforcement   Photographs - they are a direct representation of the scene with no bias other than lens choice and camera position. I could, however, say the same for 3D renderings.

Law Enforcement   Photos - can take as many as needed from different perspectives, close-ups, with/without scale.

Law Enforcement   Hand drawn maps w/ measurements, 2D images, photographs, 3D renderings - all give the best representation due to different perspectives.

Law Enforcement   3D renderings, however w/sketch/diagrams can include labels and measurements - would be good for both to work together. 3D renderings "tell a story" very well and definitely put the viewer in the crime scene - would play well to a jury.

Law Enforcement   3D provides the most context, but other 2D images, photographs, and sketches can assist with clarifying any information.

Law Enforcement   Maps, photographs and 3D renderings

Law Enforcement   "1 - Photographs - more accurate, less distracting
2nd choice would be 3D renderings to assist with overall scene awareness."

Law Enforcement   "1. 3D images: Brings crime scene to life in a way that a still photograph cannot. 2. Photographs: These should always be shown in conjunction with 3D."

Law Enforcement   "1. 3D rendering - slower fly through give context of scene

2. 2D images - allow for consumption of information digital markers for evidence and measurements."

Law Enforcement   2D images tent to better for me at a birds eye view because they are more detailed about the entire scene. However, 3D renderings are a close second.

Law Enforcement   3D - "brings the scene to life" Adds a greater effect to potential crime scene.

Law Enforcement   3D - Due to its ability to display various aspects of a crime scene, i.e. depth, position, in one rendering as opposed to viewing several photos or drawings to come to the same conclusion.

Law Enforcement   3D - especially for court - showing the 3D image to the jury would be easier for them to visualize.

Law Enforcement   3D - I can assess for myself

Law Enforcement   "3D - places you in the crime scene; Photographs - if done well, plenty of information"

Law Enforcement   3D and hand drawn to cross reference.

Law Enforcement   "3D because gives a better representation of the whole crime scene at all angles. Second choice: Photographs."

Law Enforcement   3D because gives full unbiased representation of the scene. Less prone to human errors.

Law Enforcement   3D because it gives a total context of the scene.

Law Enforcement   "3D for context and orientation; images or handrawn after"

Law Enforcement   "3D for context, but should also have drawings/graphics to help pull out some of the evidence, etc. that is not necessarily apparent.

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Law Enforcement   3D gave the best overall picture of the scene. You could really see the entire landscape which is very important. It also helped to tell the depth of graves better.

Law Enforcement   3D gives viewer a view of environment especially outdoors.

Law Enforcement   3D if measurements are shown. It gives a good context for the scene and can give others that weren't there reference for being there.

Law Enforcement   3D if you can pause it. Sometimes the constant motion gave a headache or I'd want to be able to pause the screen, scrutinize and manipulate (turn) the image on way or another.

Law Enforcement   3D images. They provide an almost exact replica of the scene and when 1 person sees the 3D image. It is a first person perspective. 2D, hand drawn maps (not to scale) and photographs do not give the full picture.

Law Enforcement   3D is excellent and provides more detail, however the authenticity of a photograph cannot be challenged or duplicated.

Law Enforcement   "3D offers context to other information provided/available. Can decipher information more quickly. Second choice: Photographs"

Law Enforcement   "3D provides a better visual representation, including relationships of distance, space, etc. Second choice: Photos"

Law Enforcement   3D provides exact details and context.

Law Enforcement   3D rendering - Appear most accurate. Would give jury more accurate representation of crime scene. Would most accurately support findings/evidence found in relation to location, to include specifics/and or prosecution/defense testimony.

Law Enforcement   3D rendering - because it combines all of the other methods. Also, jurors like to see the technology and expect it from law enforcement.

Law Enforcement   3D rendering - due to the ability to merge photos and measurements.

Law Enforcement   3D rendering - For me, this type of evidence essentially includes the same information as photographs. The renderings can be slowed down or stopped, allowing the jury to feel like they are at the scene. Additionally, measurements can be easily determined between two points with the click of a button.

Law Enforcement   3D rendering - gives better perspective and context of the scene.

Law Enforcement   "3D rendering - more detail of crime scene (depicts more details of environment than other methods).

Law Enforcement   3D rendering as long as you can still capture detailed imagery of photographs.

Law Enforcement   3D rendering because it gives more context

Law Enforcement   3D rendering to show overview of location.

Law Enforcement   3D rendering. I have been using 3D scans for over 10 years. The amount of data collected is by far better than using a total station or other hand held measuring device. Hand held measuring devices (i.e. tape measures, etc) allow too much interpretation by the user. Also, everything inside the crime scene is visible and measurable using 3D scans. It also allows a "virtual" return to the crime scene to reevaluate evidence.

Law Enforcement   "3D renderings - gives more explanations, more animation.

Law Enforcement   3D renderings - simply able to capture more information. Photographs are great, but there are certain things that fail due to human error or conditions.

Law Enforcement   3D renderings and photographs. 3D adds context, depth, measurements. Photos focus in on evidence, details, etc.

Law Enforcement   3D renderings are better because of environmental comprehension. However, 3D furthers the problem of jury "CSI" effect

Law Enforcement   3D renderings can be good if enough work (i.e. time) are put into them.

Law Enforcement   3D renderings first, primarily due to the total context of the scene that can be visualized. Photographs are second best.

Law Enforcement   "3D renderings orient the viewer the fastest and most accurately, in my opinion. 2nd best option - photographs"

Law Enforcement   3D renderings show the crime scene in a contextual relationship for orientation of the evidence.

Law Enforcement   3D renderings show the scene from many different angles and gives a "real" representation of the scene.

Law Enforcement   3D renderings were the most comprehensive and put the scene into context with respect to the surroundings and how the body fits in to the overall surroundings.

Law Enforcement   3D renderings, provide a real life comparison to see a crime scene without having to be present.

Law Enforcement   3D renderings. 3D renderings because it brings you into the room. Its why as an investigator I always want to go to the crime scene.

Law Enforcement   3D renderings. Allows you to "walk" through the scene.

Law Enforcement   3D renderings. For those who are not familiar with how crime scenes are processed, to include sketching, it may be very difficult for them to truly picture what the crime scene looked like. With 3D renderings, it leaves nothing to the imagination.

Law Enforcement   3D renderings. I felt that the 3D renderings provide a better overall image of crime however using all methods would provide the best understanding of a crime scene.

Law Enforcement   3D renderings. Puts juror in crime scene.

Law Enforcement   "3D renderings. Because they best represent depth of field (than photos or drawings)."

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Law Enforcement   3D renderings: much much more information, precise measurements, photos in color and context all rolled into one.

Law Enforcement   3D shows more detail about the scene.

Law Enforcement   "3D shows total scene in 3D and all sides
Photographs shows still representation of scene."

Law Enforcement   3D was surprisingly good at representing the scene. I honestly did not think I would prefer it until I saw it.

Law Enforcement   3D, because you can look at different angles, and shows you depth

Law Enforcement   3D, but it depends on what you are trying to demonstrate/prove. 2D is also good. Hand drawings are more difficult to see and read and to put into context.

Law Enforcement   3D, full range of motion and overall layout of room/area provided useful context.

Law Enforcement   3D, it provides more context of the scene and ties the scene altogether. Being able to view the crime scene in 3D format makes it much easier to see everything in the scene, that might be missed in photos or sketches.

Law Enforcement   actual video or pics

Law Enforcement   All of the types help make people understand a scene more.

Law Enforcement   3D as it is a better representation of the scene as it provides more information.

Law Enforcement   3D because I believe it shows context that the others can't show some materials.

Law Enforcement   3D because I can see the crime scene for myself.

Law Enforcement   3D because it provides more context when reviewing a scene. A simple drawing doesn't bring it to "life".

Law Enforcement   "Believe all method should be presented and used. Each method was providing information that was not found in the other method. It was difficult to determine depth in the 3D maps.

Law Enforcement   Combination of methods (map with photography). However, the 3D provides angles and an overall representation (depth, centered) that cannot be depicted in other methods.

Law Enforcement   Combination: Map (digital), photographs, 3D

Law Enforcement   Different scenes and circumstances could make one method preferable over another. I believe all should be available and considered in each homicide scene.

Law Enforcement   Documentation taken out of context of larger collection of evidence is very difficult to assess. I think 3D images could be a useful tool that adds information and helps juries to understand (already use in form of models), but is not a replacement for other tools. One photo is never taken. Its a series of photos. Graphs/drawings in some cases can represent layers better (body on top of gun). I think due to TV expectations by juries, there will be distrust by juries of law enforcement w/o 3D representations. We see this issue when interviews are not recorded. There is a danger of giving up law enforcement methods in public trials as well.

Law Enforcement   Even though the 3D renderings are more expensive, to me they provide the best image of the crime scene.

Law Enforcement   For the future definitely 3D because give a better understanding of environment (i.e. depth of grave, topography, etc.) photographs for basis of set way things look. Think this is based on demographic of jury and type of trial.

Law Enforcement   Got lost in the 3D rendering and it look many times to figure out what I am looking at.

Law Enforcement   Hand drawn and photographs. I don't have access to 3D renderings.

Law Enforcement   Hand drawn because they provide precise measurements, however 3D provides best over all picture for mental recreation.

Law Enforcement   hand drawn/2D images show some evidence better than some photos/3D scanning. the 3D scanner provides better context.

Law Enforcement   I am most comfortable with "old-fashioned" photos and maps, but the 3D renderings are very helpful (I am new to them). I find myself wanting to "pause" the video, so hopefully they could be used together.

Law Enforcement   I have used all of them, or processed scenes where they were all used, including a mass shooting scene. I believe there is value in utilizing multiple technologies. Hand drawn maps and 2D images allow you to reduce clutter and focus on items/details of interest, however nothing provides better contextual information or a truer sense of the scene than a 3D rendering. In addition, 3D rendering allowed us to much more quickly and accurately document the position of dozens of bodies, speeding up the processing and allowing me and families to begin their processes more quickly.

Law Enforcement   I like drawn maps and photos. Maps to give distances - location, photos for more visual 3D if one has the technology.

Law Enforcement   I like photos because it is a real world representations of color tones/condition of scene, etc. I do prefer 3D over sketches and other representations.

Law Enforcement   I like the 3D best to represent the crime scenes portrayed, however there are crime scenes where this might be difficult to solely rely on i.e. a dirty crime scene where things are scattered about a home and so crowded that one room (kitchen) is indistinguishable from the next (living room). The scenes portrayed make clean and clear cut. I would say that the 3D does best represent the scenes but I would also like to have the other techniques available to me as an investigator to highlight certain things of interest.

Law Enforcement   I love the 3D imagery because it seems to show the whole scene as if you were standing and walking around and can get views that are not seen in the others. Granted with enough photos from different angles you can see, but its quicker and easier in 3D than sorting through photos.

Law Enforcement   I prefer 2D images (if they are taken in good quality covering multiple angles). They are stationary are easier to look at then something moving. 3D would be nice if you could slow the speed down. 2D images are portable. 3D is nice if combined with 2D. 3D may be preferred in some cases.

Law Enforcement   I prefer 3D images, as it lends context to each image, and better demonstrates spatial relationships between victim and evidence, in a way which informs a narrative.

Law Enforcement   I prefer 3D renderings because it allows for a better spatial understanding of the total scene. In some instances (e.g. blood spatter) the 3D documentation could be incredibly relevant. Additionally, that rendering is easier for me to understand.

Law Enforcement   I prefer 3D. It allows me to see the scene as close to the way the ERT show it. Sometimes photos don't properly represent depth and detail.

Law Enforcement   "I prefer both 3D imaging and photographs. Love the 3D, but I'm an old-time investigator, and want to see photos. I don't rely much on notes, as they are less accurate."

Law Enforcement   I prefer hand drawn maps, 2D images, and photographs because that is what I have always used. I would not be against the new technology if it were available to me, and would love to learn how to use it properly if it were provided.

Law Enforcement   I prefer photographs and hand drawn maps because the 3D scans moved very quickly and I felt like I could see more with the still images.

Law Enforcement   I prefer photographs as 3D renderings can be changed and manipulated.

Law Enforcement   I prefer photographs because I know I am looking at actual scene.

Law Enforcement   I prefer photographs because they can show several different angles and close ups of the actual scene. I think the gruesome aspects of some crime scenes can only be shown in pictures. Maps and drawings don't have the emotional impact for juries as pictures do.

Law Enforcement   I prefer photographs since the detail they add is more granular than 3D images. Though I do believe 3D images are an excellent way to present the overall crime scene to the jury at an overview level.

Law Enforcement   I prefer the 3D because I can see deep better, the surroundings, curves and slopes; I would however, like to see the measurements added to the 3D so I know how deep it truly is. The drawing shows measurements but the 3D gives a good idea of what those measurements are likely to be.

Law Enforcement   I prefer the info from 3D imagery but imagine equipment would be large and expensive. Photography is practical.

Law Enforcement   "I prefer to use a documentation method that best assists me in my testimony to a jury. The 3D rendering is good to best display the overall scene and relationship of items of evidence to one another. I prefer still photographs when testifying about individual items of evidence. Second option: Photographs."

Law Enforcement   I think 3D is useful, but there is 2 of irrelevant info being seen in the video. Sometimes the sketch or photo can focus on what is most relevant to the scene.

Law Enforcement   I think all methods together give the most information about the scene; so they should all be included.

Law Enforcement   I think I would prefer a combination of the above things. The 3D imaging seems better for overall scene view and measurements but in a heavily covered area I could see the value of drawings and 2D maps to show evidence locations not picked up by 3D mapping as well as adding photographs to support that.

Law Enforcement   I think using multiple methods is the most effective. They all bring something to understand the scene.

Law Enforcement   I would prefer the 3D renderings, because it tells a better story to the jury.

Law Enforcement   If Faro, 3D renderings with 2D images as supplements. 3D images can also render wireframe diagrams in 2D, from multiple angles - they (in addition to) take measurements. I believe to 1/1000 inch at the ranges shown, so they can supplement hand drawn maps (and perhaps) and total station. You still need ability to have 2D photos because the resolution/focus settings are good for the 3D view, in general but not for excellent focus/depth of field critical for fine detail. So scans = photos (overall) and general diagrams.

Law Enforcement   If I had only one, I think 3D renderings provide the most information. However, I think the best method of documentation is a combination of photographs and 3D renderings since the movement of the 3D model can be overwhelming or too quick too focus on

one item or area so a still photo would assist that.

Law Enforcement   If I were a juror, I'd prefer 3D however you have to be sure all measurements are properly taken to ensure an accurate depiction. As a CST photographs are extremely important but I would use the 3D renderings as part of the case documentation.

Law Enforcement   It was difficult to see bones in the scattered scene.

Law Enforcement   3D Not sure on the procedure of 3D but I would prefer not to rely on a single method but rather use photos to aid sketches and sketches/2D images to add content to the photos even 3D may need labels.

Law Enforcement   Overall representation, accuracy for evidence depiction, scene, comparison, etc. can account for much greater detail overall of scene.

Law Enforcement   Photograph, shows best amount of detail for evidence purposes.

Law Enforcement   Photograph, the 3D scanner can't be used on every scene/weather.

Law Enforcement   Photographs - they are not interpreted - they are a still representation of the scene at the time and can't be created.

Law Enforcement   "Photographs - true representation of scene, but loses depth
3D rendering - great information but potential distrust of animation"

Law Enforcement   "Photographs- am most familiar with this documentation method, and in analyzing them for purpose of conducting further investigation. 3D may be the best depiction."

Law Enforcement   Photographs and 3D are the best in my opinion because it is clear and is the best image of the overall scene.

Law Enforcement   Photographs and 3D maps because there is less room for human error or misrepresentation in court.

Law Enforcement   Photographs and 3D renderings - real and contextual

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Law Enforcement   Photographs and 3D renderings. With handrawn maps some things get missed.

Law Enforcement   Photographs are exact representations of the crime scene. 3D renderings add great context. Prefer photos as primary.

Law Enforcement   Photographs make a more clear representation of the scene.

Law Enforcement   photographs show what was at the scene not a rendering of what was there.

Law Enforcement   Photographs shows actual scene from personal look.

Law Enforcement   "3D images moved too fast, cognitive load in processing
If 3D video can be ""de-xboxed"" to enhance ""authentic"" feel"

Law Enforcement   Photographs, but a combination of all available methods is best.

Law Enforcement   Photographs, evidence and key items can be marked rulers in grave/pit can be shown for depth.

Law Enforcement   photographs, less room for human error.

Law Enforcement   Photographs: cannot be manipulated or altered as compared to a digital product based on computer program. Plus they capture the scene immediately after the crime.

Law Enforcement   Photographs: Photographs accurately depict the scene as it is int he purest form.

Law Enforcement   Photos - clarity. 3D full visual rep of scene.

Law Enforcement   Photos - Juries prefer photographs in my experience

Law Enforcement   Photos - They provide accurate representations of crime scene. I would use the 3D in concept to gain overall perspective.

Law Enforcement   Photos with sketches. 3D renderings, although neat looking, are not as clear as photos or sketches.

Law Enforcement   Photos, with evidence; I think people like to concentrate on an image. I would like 3D if it can be stopped.

Law Enforcement   "Prefer 2D because I am used to it. 3D is preferable to hand drawn maps Younger generations likely more comfortable with 3D. Would prefer 3D to present to a jury."

Law Enforcement   Prefer high-resolution photos from multiple angles from a trust perspective, due to higher confidence nothing can be manipulated via computer. Not as important, prefer 3D for a full contextual perspective/offers the most complete visual.

Law Enforcement   "Preference of technique is a tie depending on the quality and amount of crime scene pics. Based on experience as an investigator I want pics, but juries would process a 3D map (slower), would help.

Law Enforcement   Provide caveat to explain how 3D rendering to know they are actual photos put into 3D helps.

Law Enforcement   "Some of the 3D renderings were distracting, moved too quickly and the contrast was 4 off (too bright - hard to see the bones). The photos tended to be more clear and straightforward. However, the last 3D scan shown was not distracting and made the scene much clearer. Therefore, I guess I prefer photos overall, but 3D if done like the final 3D image would be helpful to supplement. Best: Photos. Second best: 3D images.

Law Enforcement   The 3-D renderings are incredible, and would be considered indisputable in any court.

Law Enforcement   "The 3D renderings show far more detail than drawings/photos. I think the 3D representation should be in addition to photographs of the crime scene. Both serve a valuable purpose. Second option: Photographs"

Law Enforcement   The 3D version. You get a sense of depth and can see the scene from different angles.

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Law Enforcement   The photographs were clearer and the black anomalies in the 3D image were a distraction.

Law Enforcement   Why use one at the exclusion of others? I think 3D can supplement hand drawn maps and photographs, but shouldn't be used exclusively i.e. for second collage image the hand drawn map is really effective and is less distracting in some ways because you don't just focus in on the body.

Law Enforcement   with option, I prefer to have them all.

Other   I like 3D except for not being in control of it i.e. not being able to pause it to see still image.

Other   3D and photographs of crime scene.   Reason is because pictures depict more of the actual scene. Hand drawings are based upon an individual's perception

Other   3D- I felt it gave me more of an overall view of the scene and a better picture of what happened.

Other   3D - complete view of scans

Other   3D - It feels as though I'm there in person.

Other   3D - spatial relationships are more accurately presented. It does not seem to be affected as much by shadows as photographs or human error like hand drawn or computer-generated maps.

Other   3D gives more detail of the victim and the area. It includes depth and detail you can't achieve with any other method, including pictures.

Other   3D gives more evidence that may lead to the exact number of years the victim was there.

Other   3D maps! You get to see everything at the scene, without actually having to be there. You miss no details, unlike hand drawn maps because humans are prone to error. And the pictures are helpful, but they don't provide everything all at once, nothing is connected.

Other   "3D more robust view and holistic picture. Second choice: Photographs"

Other   3D primary choice. 2D can do a good job but need to be best detail possible.

Other   3D rendering gave me more information than a photo. Multiple photos from different angles would have also helped.

Other   3D renderings - provide a clear view of the crime scene and give ideas of space, context, and location.

Other   3D renderings because it gives you full crime scene.

Other   3D renderings because they allow you to see all aspects of the scene as if you were actually there, instead of focusing on specific features or discussing any that may be of great importance.

Other   3D renderings because you get to basically relive the scene.

Other   3D renderings for the most part -- the hand drawn map does provide "just" the bones and evidence - which is obviously helpful, but overall the 3D renderings are best.

Other   3D: It offers people 2 of different views of the crime scene. In the case of an explosion, it offers people a view a few seconds before the events.

Other   3Dbecause it represents the scene better. I feel more secure in my opinions of the scene.

Other   For me a better visualization with photos and 3Ds

Other   I like the 3D method as it conveys more contextual information regarding the crime scene, however I prefer photographs of the body.

Other   I liked 3D and handdrawn. Sometimes was better to see hand drawn which removes surrounding items and gives a more clear picture of bone positioning.

Other   I prefer 2D maps if the quality of the 3D renderings remain inconsistent. I do think, when the image is clear and not blurred, 3D renderings give the most accurate depiction of scene context as a whole. However, 2D maps with contour lines are excellent at depicting the individual bone elements. So I think in court it depends on what the jury should be focusing on.

Other   I prefer 3D because this provides the most information and leaves the least left to a juror's imagination. I would have liked the 2D maps more but without a key to the topography markings, I found them difficult to interpret. Photos combines with 2D maps may be a best compromise for lower budgets: 2D provides the bird's eye view that is really needed to provide context and photos can supplement with detail. Drawn maps are always least effective because of human error.

Other   I prefer 3D mapping because it gives you what you can see underneath the body vs. the other documentation methods. And hand drawn maps and 2D images can sometimes be inaccurate.

Other   I prefer photographs, but in most of these instances the photographer did not zoom in enough to tell fine objects such as small pieces of evidence. I prefer 3 D over 2 D because it explains how the body is positioned better. Hand drawn maps are least helpful or most helpful depending on the detail and skill of the artist. So my ranking is photographs are best, then 3D renderings, then 2 D maps and hand drawn maps about the same depending on the skill of the artist. The 2D and 3 D renderings both have 2 of background 'noise' that make it difficult to detect fine detail.

Other   I prefer the 3D rendering because it provides the most information. General settings, relationship of evidence to the body, and documentation of evidence/lack thereof in the surrounding rooms. It is as though you investigated the scene yourself.

Other   I prefer the 3D renderings because you're able to see all angles and depths of the crime scene. It will stick better in someone's mind.

Other   I think the 3D imaging is much closer to what I see at a scene (add smellovision :)) if I were on a jury, the 3D gives me much more of a feel for what the investigation saw at the scene. I'd be more than happy to take one back to NM and test if for you :)

Other   I think the 3D renderings add to other kinds/pieces of documentation, but I think still photos and sketch maps are still helpful for understanding the context of what is represented in the images.

Other   It's close between photos & 3D images; the 3D images personify the long dead victim moreso than the photos and other documentation. It is important for a jury to grasp, as possible,

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the last moments of life of the victim.

Other   3D- offers context of angles that other methods can't capture.

Other   Overall I think the 2D offered the less altered view. Sometimes 3D or photo can distort the situation.

Other   Photographs - very clear unlike the 3D viewing, I do like having measurements that come with 2D images.

Other   photographs as well as 3D. The depth needs to be seen, which photographs cannot see.

Other   Photographs provide such a great way to bring someone not present at the scene to the scene. However maps give such an accurate spatial relationship. So 3D renderings because it combines all of these.

Other   Pictures were very helpful for seeing depth and actual details. 3D distorted the image a bit.

Other   The 3D gives much more definition, it was much easier to identify the depth of the graves and to see more details to the whole scene. Photographs: it gave you exact details and spacing so you dont have to rely on peoples drawings

Other   The 3D would be helpful in visualizing what the crime scene looked like, but the details of the photographs are more clear. I believe that a combination of both 3D and photographs would be the best method to present.

Other   "While 3D video was helpful, the speed of the video and the blurriness of the images made it difficult to discern details...especially "beyond a shadow of a doubt." The 2D images were very helpful to see the details sometimes hidden by the blurriness/speed of the video."

Retired 3D because it provides more perspective on the crime scene.

Retired 3D easier to see

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Retired 3D gives a more complete picture of the scene.

Retired 3D- It gives a better view of the crime scene. Better reference to each item.

Retired 3D- more information in context

Retired 3D- see all details

Retired 3D shows the crime scene in context.

Retired 3D- the lighting and surrounding area, i.e. ground and soil type, show real conditions.

Retired   2D images. To me they provide more complete and accurate information.

Retired   3D, I have seen it used before.

Retired   3D - context is shown, and viewing objects from different perspectives is very helpful - sometimes critical.

Retired   3D environment is easily ID and does not require imagination or individual interpretation.

Retired   3D gave more depth the scene, photographs would be good (If you took enough to "get the whole picture". The maps with the measurements was also fair.

Retired   "3D rendering is #1 I like the technology of it. Actual photographs are my 2nd method, it is old reliable"

Retired   3D renderings because it shows the surrounding landscape and gives a better idea as to depth of grave. Gives a visual image especially when remains are scattered.

Retired   3D Renderings; provided a more realistic view of the crime scene and provided more accurate information. Less subjective than drawings, which may not capture everything if the drawer misses anything.

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Retired   3D- able to see different perspectives, greater flexibility.

Retired   3D Better idea of crime scene

Retired   3D better perspective of the area.

Retired   Both photographs and 3D renderings are more useful for detail and reliability. 3D however as in final photo can also provide clearer info re: evidence in adjoining rooms.

Retired   Hand drawn involves a person's perspective and drawing abilities. Photographs limited by light, angles, etc. 3D provides better overall viewing of scene.

Retired   Hand drawn maps.....easier to visual the placement of the body parts.

Retired   I like photographs the best. But, 3D rendering does help.

Retired   I like them (3D) for a room. I didn't like for a grave - 4 harder to see clearly than a sketch drawing. But didn't like the pencil drawing.

Retired   I prefer photographs as they are easier to see the actual remains because the 3D is somewhat distorted for me.

Retired   I think photographs are best - if they are clear and easy to understand and see... but jurors are not trained - so a 2d or 3D add would be helpful to be able to understand what they are looking at.

Retired   I think you should use more than 1 method. A real photo of the scene is vital but hand drawn maps make the photo image clearer in the viewers mind.

Retired   It gives many angles and views, much clearer what is where.

Retired   3D- only if they can be "paused"

Retired   Photo - it's a true picture of what happened. Hand drawn would be second choice. It can be studied along with a photo.

Retired   Photographs - were better than the videos.

Retired   Photographs are easier to study for the details and show everything in place.

Retired   Photographs show the true scene, but are always framed at a distance. Sometimes image is unclear. Drawings also were not always clear images. Tough decision. I think a series of close-up shots, shown together with 3D drawings would be a good combination.

Retired   Photographs taken from different angles would be my preference. The 3D rendering offers the opportunity for changing the image since it is computer generated. How can I be assured that is connected to the "real" evidence?

Retired   Photographs when surrounding topographical information is included

Retired   photos and 3D are about equal. Hand drawn are more personal concept and could leave something out.

Retired   Photos and 3D renderings offer more info.

Retired   Photos are more clear.

Retired   Photos because 3D renderings is a rendering, not actual photo.

Retired   "The 3D images were helpful but couldn't be easily controlled for speed of viewing -- felt they went by too fast. Would have preferred controlling the view and angle myself. 2D maps are helpful but in large measure because the artist has made some decisions on behalf of the person viewing -- this interpretation could be misleading for a juror. Photos gave time to examine the scene carefully and independently. Thank you!"

Retired   The 3D renderings make more of an impression on me... appear more reliable than hand drawn - to me... But all documentation would be best for laymen on jury.

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Retired   There is more detail to review in a 3D image. For instance, on a 2D or hand drawn map, how easily could you decide (as a jurist) whether a grave is shallow or deep? I saw more evidence in the 3D than I did in the 2D. Getting it from different angles is very helpful.

Retired   They all have their pluses and negatives, hand drawn hardly usable. Photo of any type and lots of them.

Retired   visual is better

Retired   You can see everything typically, but is representative enough to tell the basic crime scene particulars. Very informative! Thanks

Student   It really depended on the situation. Burial graves were well shown with the 3D and 2D. The hotel was great with hand maps, 2D and 3D. Hand drawn maps for burials almost took away from the context.

Student   Photographs to show an overview of the scene, hand drawn maps to show measurements and show what you see, 2D to show another perspective, that would make it easier to understand the image well compared to hand drawn.

Student   2D images but in terms of a jury, I think they would connect and understand the 3D one more.

Student   2D images provide more useful info and less clutter.

Student   3D because i like being int he room

Student   3D because it give full area outlook to try and see other things you couldn't see in picture

Student   3D because it is the most detailed

Student   3D because it shows more and is basically includes all the other ones together so they all work together to make it better

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Student   3D because it was the most realistic

Student   3D gives 2 of info to the scene, and help orientate you in the scene.

Student   3D gives a better holistic picture of the scene

Student   3D I feel it basically showed you the actual crime scene and if there is anything missed you can just go back. Also there is no concern as to if someone purposely missed something.

Student   3D maps give a more complete picture.

Student   3D only because it allows you to see all angles of the scene.

Student   3D or 2D representations were best. If able to manipulate the 3D myself, that would be first choice. However, in a presentations the speed of the rotation/lack of identifying key can make them hard to interpret. Gives better representation of depth and context.

Student   3D rendering because it feels like I'm actually there.

Student   3D rendering because it gives a better overview of entering the crime scene but also gives you a variety of angles that pictures can't capture as well.

Student   3D rendering because it is so much easier to see everything

Student   3D rendering because it showed everything from the remains to evidence and the environment the remains were found in

Student   3D rendering because they were easier to analyze

Student   3D rendering because you can see the whole scene and its more life like

Student   3D rendering gives the most detail but I wouldn't understand how the data is manipulated to make the 3D image

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Student   "3D renderings   for the most possible information about the crime scene to be displayed. 2D images: in the provided cases they were easier to understand than photographs or hand drawn maps"

Student   3D renderings and hand drawn maps, 3D images because you can place yourself at the crime scene but the hand drawn maps can make it easier to see what is there.

Student   3D renderings because angle isn't subjective, all evidence is visible, measurements are accurate and creates a good idea of a crime scene walk through without actually being there (most impact, appeals to emotions.)

Student   3D renderings because everything was well displayed. However I do know that they may not be 100% accurate every time.

Student   3D renderings because i can see all angles and perspectives which provides the most information

Student   3D renderings because I feel like they are more engaging and immersive. However, I think photographs are just as good. Maps are good for the mapper but not always for an audience.

Student   3D renderings because it gives full coverage of the scene. 2D images because it gives 2 of context

Student   3D renderings because it gives you a feel of what the scene truly looked like

Student   3D renderings because it is able to show all the intricate details of the scene like depth of graves/pits, evidence, overview, etc. It would give like an experience to the jury as if they are there since it goes even to how to get to the scene.

Student   3D renderings because it shows you everything from different angles with more detail

Student   3D renderings because they are actual evidence and are more detailed

Student   3D renderings because they give a clear representation of the crime scene. it is clear to see what the crime scene looks like, what environment it's in, and often show measurements. They basically combine all of the documentation methods

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Student   3D renderings because they give me a display of the whole area and make it easy to understand

Student   3D renderings because they provide a view on the crime scene form multiple varying angles and viewpoints

Student   3D renderings because they provide the individuals viewing the scene with a better understanding of the scene as a whole.

Student   3D renderings because we were able to see depth

Student   3D renderings because you can get a better look at how the body is placed and where it is

Student   3D renderings because you can see more than what are in the photographs

Student   3D renderings because you get a more accurate depiction of the entire scene at various angles and the setting it take place in

Student   3D renderings because you see everything. You see the entire scene, the depth of graves, the environment. It is talking you through the crime scene with the investigators.

Student   3D renderings due to the fact that it shows the whole scene in a way impossible to see in a 2D image.

Student   3D renderings- gives a more clear precise picture and context that can be easily viewed and understood by jurors (for example).

Student   3D renderings gives you more context, not just a picture of a grave

Student   3D renderings if possible because so much more info can be included, but if not available photographs.

Student   3D renderings it lets you see as much information as possible

Student   3D renderings it showed the individual and the surroundings the best compared to the others.

Student   3D renderings not only because it adds to more contextual info for forensic experts, but it also is more easier for jury members in a court to view and understand.

Student   3D renderings with images draped over topography give the most accurate and unbiased representation, if properly processed (adjusting lighting and fixing glitches)

Student   3D renderings you can see from different angles and the environment around the scene

Student   3D renderings, because they gave a more accurate picture of the scene and evidence present.

Student   3D renderings, because you can explore the scene virtually as if you were walking through in real time. You might be able to notice details you hadn't before, etc. However, colorings and real life details can probably never be replicated better in 3D unless you did an actual camera set up.

Student   "3D renderings, due to their ability to show the surroundings. 2nd: pictures because i feel they give the most detailed images of the scene itself "

Student   3D renderings, they provide as much information as possible and we should take advantage of that.

Student   "3D renderings, when it comes to a jury they need clear representation and the 3D model gives it form all angles. though it is hard to see when it is scattered on the ground. 2nd: 2D images, it gives a clear map that is easy to look at when bones are scattered in a wooded area. "

Student   3D renderings, because you can always go back and catch small details you might have missed

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Student   "3D renderings; they give more context; 2nd : 2D images they are good quality"

Student   3D renderings--most realistic, feels like you are there. I like seeing the real thing/evidence

Student   3D, I got several different views of the scene without seeing several photos or drawings, I also think it was easier to see examine detail.

Student   3D. It shows you an exact replica of the scene.

Student   although photographs are effective, the 3D renderings provide better context

Student   3Dbecause you get a fixed image that you can analyze; all different ways. We can measure the depth/pit, the accuracy is tremendous.

Student   Each of the 2D representations shown could have better covered the scene to include certain contextual information, but if they aren't giving every detail, then 3D renderings are often more complete.

Student   I find 3D rendering more useful and helpful because it provides an exact replica/image of the scene and how each item relates to another. It allows the viewer to feel as though they are at the scene.

Student   I have no preference, but the 3D seem to give a more complete view of the scene.

Student   I think 2D images are the best because it is still and exact. Secondly I'd prefer 3D rendering because it is exact

Student   I like both 3D and photographs, it's easier to see the details and overall crime scene.

Student   I like the 3D rendering it gave all the information needed

Student   I like the 3D renderings the best. They give multiple angles to see the scene, I would prefer them to photos so that images are clearer though.

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Student   I like the 3D videos the best. However, it constantly spinning never allows you to have a good look at the positioning of the evidence. I had a very difficult time concentrating on if the arms or knees were bent. Or the video was not clear enough, especially on the example that was very spread out. I think that video would've greatly improved if it zoomed in on each piece of evidence and positioning. Despite these critiques, the 3D imaging provided a lot of information of the surrounding and the depth of the grave/pit.

Student   I like the actual photographs, 3D images can leave things out

Student   I prefer 3D rendering. Its more true for us to see and understand

Student   I prefer 3D renderings as they more realistically demonstrate the proportions of crime scenes and spacial relationships.

Student   I prefer 3D renderings because it can put you in a crime scene without actually having to be there.

Student   I prefer 3D renderings because it feels like you are at the crime scene. However, sometimes the quality isn't great, so it might need to be supplemented with photos.

Student   "I prefer 3D renderings because it gives the person multiple perspectives vs. just one; 2nd: The 2D image would be my second choice since it shows the primary crime scene."

Student   I prefer 3D renderings because it gives you a real life look at size, scale, and specific details of a crime scene. 2D images. Drawings are not always neat or to scale. Images show what is there.

Student   I prefer 3D renderings because they give a view of different angles and showed more items around the crime scene

Student   I prefer 3D renderings since it is a better visualization in a single method, it contains the sketch, notes and photo/video all in one. Overall gives a person a better thorough idea of what occurred.

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Student   I prefer 3D renderings with 2D contextual details (elevation, measurements)

Student   I prefer a combination, as when used together you get more information than when used apart.

Student   I prefer photographs and 3D renderings equally. they both provide necessary information to understand the crime scene with the 3D renderings providing additional site context.

Student   I prefer photographs as I think they are the easiest to understand. You don't need as much background knowledge to be able to look at a picture and tell what's going on. And as opposed to 3D mapping, these pictures are stationary, so it's easier (for me) to see where exactly things are. Hand drawn maps can have problems due to human error. My second best is the 2D because I think that they are easy to understand, but will require more explanation

Student   I prefer photographs because I think that they add to the context of the scene and also show more detail.

Student   I prefer photographs because you can look at certain aspects more clearly; 2nd: 3D renderings because you see the crime scene as a whole, it is just harder to see specific aspects

Student   I prefer photographs to 3D renderings because I think they can provide more crisp and detailed images than the 3D renderings.

Student   I prefer the 3D maps because you can see all angles and it tracks their point of entry. I also think it's more clear than hand drawn maps.

Student   I prefer the 3D rendering because it shows the most about the crime scene and looks most beneficial for someone trying to solve it. photographs because it gave more info than the others

Student   I prefer the 3D rendering, but I would want the presentation of all images because there might be a piece of evidence documented or drawn on a map of the scene or other information I might happen to miss in the 3D rendering. The 3D though does allow for a nice complete aerial and side views. I believe the presentation of all is best.

Student   I prefer the 3D renderings because it gave you a chance to see the whole scene as if you were there. my second choice is photographs because those were the next closest thing to being on the scene behind the 3D renderings

Student   I prefer the 3D renderings because it gives the audience a better view and understanding of the crime scene. My second preferred method is the photographs. I believe they should go with the 3D renderings to show the audience the exact crime scene

Student   I prefer the 3D renderings because they give a larger overview of the entire crime scene in one rendering that may not be able to be captured in one photograph. One rendering gives the context better than a series of multiple photos that have to be strung together.

Student   I prefer the 3D renderings because you can see the whole crime scene. I do believe photographs are helpful by preserving the crime scene.

Student   I prefer the 3D renderings out of the four documentation methods. The reasoning for this is because with the 3D, you can move around to different positions and perspectives and see things as if you, such as a jury member, were there in real life. Another reason I would prefer the 3D depictions is because since there is a lot of movement, I would assume the ability to move closer towards the remains to see things more closely (to look at evidence for example) would be possible.

Student   I prefer the 3D renderings, because I could tell how deep the graves were and see more details

Student   I prefer the 3D renderings. They allow you to see a scene more clearly and provide greater contextual clues than hand drawn maps.

Student   I prefer the 3D renderings. This method provides much better visual representations of the scenes. It allows you to feel you're at the scene. Additionally, it provide all the information such as measurements.

Student   "I prefer the photographs because it is a definite still image of the scene. My second preferred methods are the 3D renderings because it gives a scale of the scene"

Student   I prefer the photographs but if the victim is in a grave the 3D would be more beneficial to measure depth.

Student   "I prefer the photographs. It gives the best resolution quality for an untrained eye. I do like the 2D maps for their presentation of the more 3D aspects with contour lines. I think the 3D renderings have a lot of potential. I like that they combine the idea of a photograph but also have the potential to show the 3D effects like a contour map. My only issue with them is just that the resolution is not very good. I found myself squinting to try and decipher the videos (even when blown up). I think if you can get the resolution quality to that of a photograph, this method will be preferable over any of the 2D methods, it's just not quite there yet."

Student   I preferred the 3D renderings and the photographs because they gave more context about the scene and more clearly depicted the remains.

Student   I preferred photographs but would have preferred to have had more photographs to get a better context. 3D renderings were useful, but the animation was not as crisp or smooth as I would have personally preferred. In scenes where remains were more easily seen, such as the skeleton in a grave, the 3D renderings were very helpful. They were not helpful in images where remains were scattered and could not be seen without some sort of marker.

Student   "I think 3D rendering was nice because you also go to see the area leading up to where the remains were. In two of photographs you only get the specific area. 2nd: photographs were my second preference because I thought it was easier to see the evidence than in any other method. Especially with the way the 3D is constantly moving it's hard to take everything in."

Student   I think a combination of 3D and photographs is the best option

Student   I think it depends on the context of the scene. Scattered remains, in thick foliage, are easier to discern in 2D images, and hand drawn maps sometimes. Articulated skeletons in graves are discernable in 3D renderings and photographs and in 3D renderings you get a comprehensive understanding of the scene beyond the skeleton. All methods in concert with one another are most useful.

Student   I think it should be a combination of both. The 3D provides great context but the 2D has measurements that can really put to scale for this grave or crime scene.

Student   I think that a combination of 3D renderings and photographs, because the 3D renderings portray the crime scene in a different perspective and puts the individual at the scene. Photographs should be used with the use of 3D renderings as a "proof".

Student   I think the 3D image really captures the entire scene and surrounding showing every detail, and the entire area.

Student	I think there is really nothing more accurate than 3D renderings. They provide so much more information about the scene than any of the other three techniques combined. As long as the 3D renderings are tested and are proven to be accurate representations of the scene, then I think they should definitely be used when available.

Student	I would prefer 3D renderings. I like to see every aspect of the room

Student	I would prefer hand drawn maps for scale of the scene, but I think 3D are a great visual tool to get the layout of a scene and see the depth prospective.

Student	I would prefer to look at photographs because you can actually see what the evidence of the crime scene is. It makes it personal and real.

Student	If I had to choose one, photographs or 3D renderings. Any real world 3D or photo image supplemented with an approximated 2D or hand drawn is best to get the most information and context

Student	In general, I do prefer 3D maps due to interactivity, there are some cases where the 3D render didn't provide enough detail (die to debitage in the scene) where 2D isolated the elements to be seen more clearly.

Student	"in terms of context for the crime scene i prefer 3D renderings but for spatial evidence and body location i prefer the 2d computer images; 2nd: 3D renderings as they provide context for the crime scene."

Student	It is dependent on what specifically you are trying to observe. 3D is important because it allows full environmental context (as close as you can get to actually being there) but when combined with other methods can highlight important features and provide different perspectives.

Student	"Photographs cause it's the real picture. No editions or nothing. 2nd: 3D cause you can get a better idea about the crime."

Student	Photograph: a clear image that doesn't move around the entire image is the best way for me to look at a body. 3D renderings. You get a good look at everything around the body and it puts you in the actual scene

Student	Photographs and 3D imaging have a tie in my mind. Both can properly convey information yet photographs may be easier for the general public to identify necessary info.

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Student   photographs because it's a clear picture of how the body was found and does not rely on technology or someone else's drawing ability

Student   photographs because it was easier to see a still shot rather than a moving picture in my opinion.

Student   "photographs because they are real and easier to understand; 2nd: 3D renderings because of all the detail they show"

Student   Photographs because they depict the actual crime scene as found by investigators.

Student   photographs because the 2d/3D renderings could miss a detail

Student   "photographs due to the fact you get a sense of where everything is and the environment it has been exposed to; 2nd: 3D renderings because it gives you all possible views"

Student   Photographs faster and easier

Student   "Photographs give the raw state of the scene. Photographs can also include information about measurement."

Student   Photographs showed a more realistic approach that shows all the details that all the others don't

Student   Photographs simple because it shows everything exactly how it was and you can zoom in or use other methods to back it up

Student   Photographs with scales added. It is hard to include any and all minute details for any maps

Student   Photographs, it is not so much up to interpretation and is typically the most clear and straightforward.

Student   Photographs. I like the idea of the 3D rendering, but the quality is not high enough to be able to distinguish finer shapes and colors. It was difficult to discern more than one

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bone from the surrounding grasses.

Student   Photographs. I have an easier time visualizing the crime scene

Student   Photos, they're the most accurate. Maybe add notations to the photos to help

Student   The 3D is great to show everything in context and it makes you visualize being there compared to a picture (even more emotion). However, photographs are second preferred for clear images, not just digital but hard copies.

Student   "the 3D model. i think it showed the most it gives more context to the scene and the crime. My second preferred method was photographs. I felt like some of the maps and other 2D things were confusing."

Student   The 3D rendering because it shows accurate measurements between objects, shows evidence, body position, and the environment the body is in, which is a mixture of the other techniques in one.

Student   The 3D renderings because it showed you the crime scene and everything around it, they were more descriptive and gave you a better understanding on things like depth and space. Photographs: it gave you exact details and spacing so you don't have to rely on peoples drawings

Student   The 3D renderings offered everything the other documentation methods did, but also, in addition, had the surrounding context and better representation of the crime scene.

Student   The 3D renderings provided the best illustration of the entire crime scene, including the surrounding context, making it the easiest to understand the whole scene.

Student   The 3D representation told a better contextual story. Not only how the body was placed, but terrain, condition, and surrounding environment. The contour map can do it as well but the average person doesn't understand a contour map I don't think. I didn't until I started working more in geology. I think people can also make intuitive guesses about the defendant based on a 3D contextual rendering because it just tells a more detailed story. It can underscore other evidence presented visually.

Student   The 3-dimensional models established measurements and depth relative to the scene, included all relevant evidence and visuals, and offered the most context to the scene.

Student   The photographs seemed more clear to me. With the 3D maps and the motion involved it resulted in the finer details being blurry. I liked that the 3D maps showed more of the foliage and trees/shrubs and for example the river and associated landscape but as far as telling that there was a body and what position it was in I couldn't really tell. Also, the hand drawings were confusing because I couldn't differentiate between what may have been a piece of bone vs say a wallet or knife easily (no colors). Taken together, the photographs were of good quality and easy to differentiate items and the 2D maps showed 4 more of the landscape that gave a better idea than just the 3D map on its own.

Student   The pixilation of the 3-D renderings make them more difficult to make out than high definition photographs.