

D7.5 SHOTPROS Final Training Curriculum for DMA-SR



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List of Acronyms and Abbreviations

Acronym / Abbreviation	
AAR	After-Action Review
DMA-SR	Decision-Making and Acting under Stress and in High-Risk Situations
HF	Human Factors
IAM	In-Action Monitoring
LEAs	Law Enforcement Agencies
PTSD	Post-Traumatic Stress Disorder
NPC	Non-Playing Character (computer-controlled avatar)
RAT	Risk Assessment Tool
VR	Virtual Reality
WP	Work Package

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Executive Summary

Deliverable D7.5 – the SHOTPROS Final Training Curriculum for Decision-Making and Acting under Stress and in High-Risk Situations (DMA-SR) – provides an extensive **evidence-based set of recommendations** for implementing VR DMA-SR training in current police curricula based on:

- Theory (see D3.2 and D7.4, conceptual human factors model of DMA-SR behaviour and D3.3, European Framework for Training and Assessment (using VR) of DMA-SR Behaviour of Professionals).
- Input and information about current training practices across European Law Enforcement Agencies (LEAs) (see D3.1).
- Results from scientific Human Factor (HF) studies and experiments with European LEAs.
- Results from the SHOTPROS field trials (D7.1, D7.2).
- Input and information on how European LEAs wish to use the concepts and recommendations.

Training practices vary widely among European LEAs (see D3.1), most prominently in terms of training duration and frequency, training curricula components, and training delivery. A common challenge for LEAs in training organisation is that the availability of training **time**, training **equipment**, and training **facilities** and **locations** oftentimes do not support the training objectives that police trainers intend (site visits, Kleygrewe et al., 2022). VR training offers a training mode to solve or alleviate some of these concerns.

The final training curriculum consists of two parts:

- Part 1: Essential considerations to implement VR in current training.
- Part 2: Seven didactical concepts for high-quality VR training & “how to” videos

In part 1, we answer the questions below. You can click on each question to jump straight to the section in the deliverable that addresses that question:

- [Which training areas are useful to train with VR?](#)
- [VR training for whom and how to organize groups of trainees?](#)
- [What is the format of a VR training?](#)

- [How much VR training?](#)
- [Should VR training be given before or after real-life training?](#)
- [Which safety measures should be taken for VR training?](#)
- [Which logistics are needed for VR training?](#)
- [What are the tasks of the trainer in VR?](#)

In part 2, we outline **seven didactical concepts for high quality training** and explain how to apply these didactical concepts in VR training. The seven didactical concepts are:

- [Clear Assignment](#)
- [Training Instruction](#)
- [Well-designed Practice Situation](#)
- [Model Learning](#)
- [Variation and Differentiation](#)
- [Self-regulation of the Learning Process](#)
- [Feedback](#)

Again, you can click on each didactical concept to jump straight to the section in the deliverable that addresses that didactical concept with guidelines.

In addition to the written guidelines per didactical concept, we provide **information videos for each didactical concept**. These videos provide trainers with relevant information on how to apply the didactical concepts in VR and allow trainers to quickly catch up on their knowledge of each concept without a lot of reading. The information clips can be viewed by scanning the **QR code** in the description of each didactical concept and tiny URLs are provided.

All LEAs involved in the SHOTPROS project made their own version of each of the didactical guidelines. They wrote the guidelines in their own words or in a form they would communicate to their organisations. This means that they added guidelines and indicated which ones they considered particularly important, but also slightly reworded points or deleted certain points because they may not be feasible in their organizational practice. This allows all LEAs — regardless of differences in training structure — to make use of the VR didactical guidelines and to conduct VR training sessions to supplement their existing practices. D7.5 thus provides a European-wide approach of didactical principles in VR in the

field of police training. The LEAs' versions for each didactical concept can be found in the appendix of this deliverable.

Taken together, part 1 and part 2 provide policy-makers and academy management with recommendations for implementing VR training into existing training structures, and police trainers and practitioners with didactical concepts as a guide for successfully conducting VR training sessions to enhance learning and DMA-SR behaviour of trainees.

This deliverable has a didactical focus and is therefore clearly distinguishable from the technical guidelines in Deliverable 7.6. We refer the reader to D7.6 for technical system requirements (graphics, animation, motion and sounds) and specific requirements for features such as After-Action Review (AAR) and In-Action Monitoring (IAM).

Chapter 2 of this deliverable outlines how D7.5 is embedded in the SHOTPROS project as a whole. Readers (LEAs) that are mainly interested in the training framework itself can proceed to Chapter 3 (“The SHOTPROS Final Training Curriculum”) directly if they wish.

1 Added Value

1.1 Relation to SHOTPROS Work Packages (WPs)

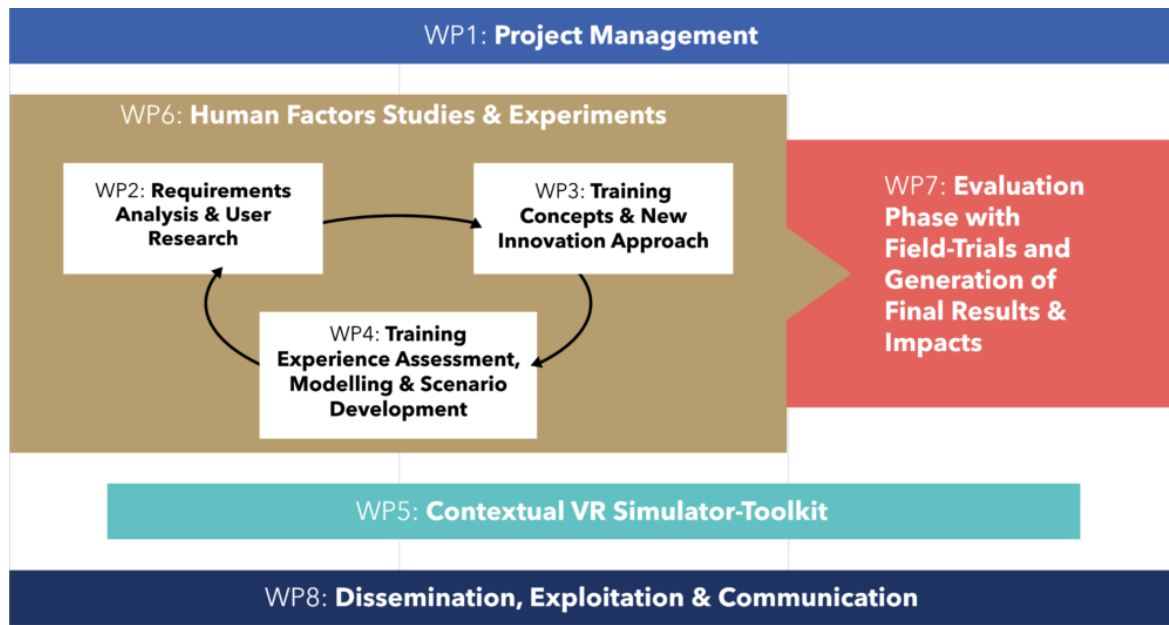


Figure 1. SHOTPROS workplan.

Deliverable D7.5 is part of WP7, which covers the final evaluation and validation of the SHOTPROS VR training environment and the training framework and guidelines (see Figure 1). This deliverable hereby focuses on the validation and enrichment of the training framework for DMA-SR presented in D3.3.

D7.5 is informed by:

Deliverable	How did these deliverables influence D7.5
D3.1	The overview of existing police training across LEAs in Europa was used to identify areas for which VR can add value to current practices. The deliverable revealed that training practices across LEAs in Europe differ in terms of duration, frequency, and components. Therefore D7.5 will provide implementation recommendations and didactical training guidelines that LEAs can use to implement VR training into their own training curriculum.
D3.3	Information from D3.3 that is evaluated, validated, and enriched in the field trials (WP7) is summarized into final training curriculum for DMA-SR (D7.5). In particular, the didactical guidelines were enriched by observing good practices during the SHOTPROS Field Trials (see D7.1, 7.2). Informed by good practices and D3.3, the didactical concepts were translated into actionable and concrete guidelines for police trainers.

D6.1	The evidence-based results of SHOTPROS experiments (D6.1) provide practically relevant information to stakeholders (policy-makers, academy management, training coordinators, trainers) regarding the use and implementation of VR training (D7.5).
D7.1	The further evaluation and final validation of the training approaches in the SHOTPROS field trials, planned in D7.1, directly impacted D7.5, the final training curriculum for DMA-SR.
D7.2	The final results of the training observations carried out during the FTs have led to an enriched and validated SHOTPROS Training Curriculum for DMA-SR (D7.5).
D7.4	The training curriculum presented in D7.5 is strongly affiliated with the conceptual human factors model for DMA-SR. The model emphasizes action as the focus of training, which aligns well with the didactical concepts in this deliverable, which are based on insights for motor learning.

Table 1. Influence of SHOTPROS deliverables on D7.5

D7.5 consequently feeds into:

Deliverable	How does D7.5 influence other Deliverables within SHOTPROS
D7.6	The final training curriculum presented in D7.5 points to (technical) requirements (e.g. Graphics, Movements, NPC Requirements) in the future development or evaluation of VR training systems as reported in D7.6.
D7.7	The recommendations for implementing VR DMA-SR training in current police curricula and didactical guidelines point to scenario requirements and therefore feeds into the set-up of successful DMA-SR scenarios
D8.5	D7.5 will deliver input that will be made available in a summarised way as part of the policy-maker toolkit that targets persons, responsible to introduce VR training into their organisations and therefore also need insight in implementation considerations for VR Training and didactical guidelines for VR training

Table 2. Influence of D7.5 on SHOTPROS deliverables.

For a clear overview on the final SHOTPROS deliverables regarding the SHOTPROS solution, the following overview is available in all introduction chapters of the regarding deliverable. Here it is visible which final deliverables influence the SHOTPROS VR solution and where to find which information:

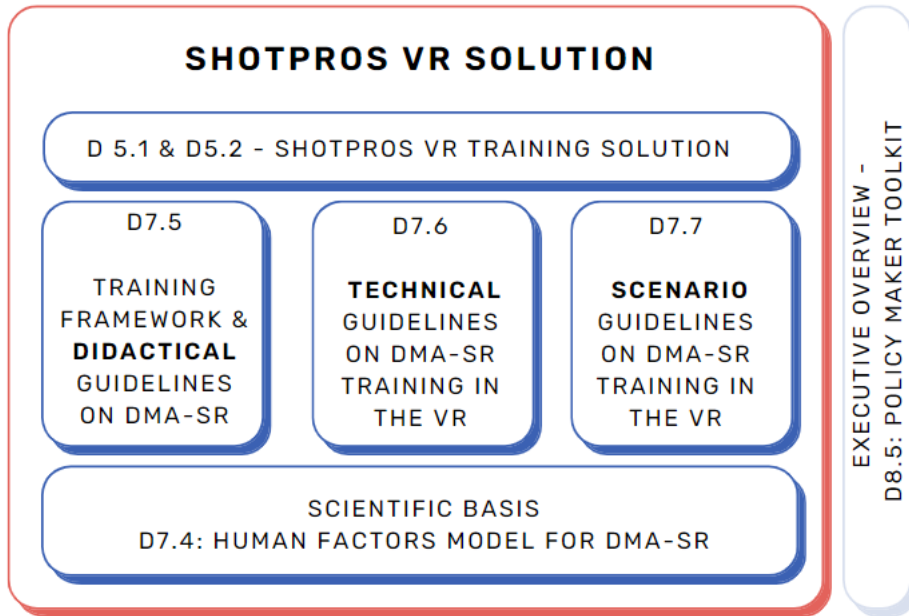


Figure 1: Overview of SHOTPROS final deliverables regarding the VR solution

1.2 SHOTPROS Objectives Relation

Deliverable D7.5 – the Final VR-Training curriculum DMA-SR Behaviour of Professionals – mainly contributes to SHOTPROS objective 3 “(European Police) Training Framework and Curriculum for DMA-SR” by providing implementation recommendations and didactical guidelines for VR training (see *Figure 2*). The initial recommendations and guidelines were presented in D3.3 and are further evaluated through field trials with SHOTPROS LEAs (planned in D7.1, results in D7.2). To meet objective 3, D7.5 comprises a training curriculum incorporating recommendations for implementing VR training in current police curricula and didactical guidelines for high-quality VR training. By this, D7.5 delivers relevant input for the technical SHOTPROS VR solution (objective 2) and the guidelines for VR training (objective 4). The European VR police network (objective 5) directly profits from the knowledge presented in the deliverable at hand.

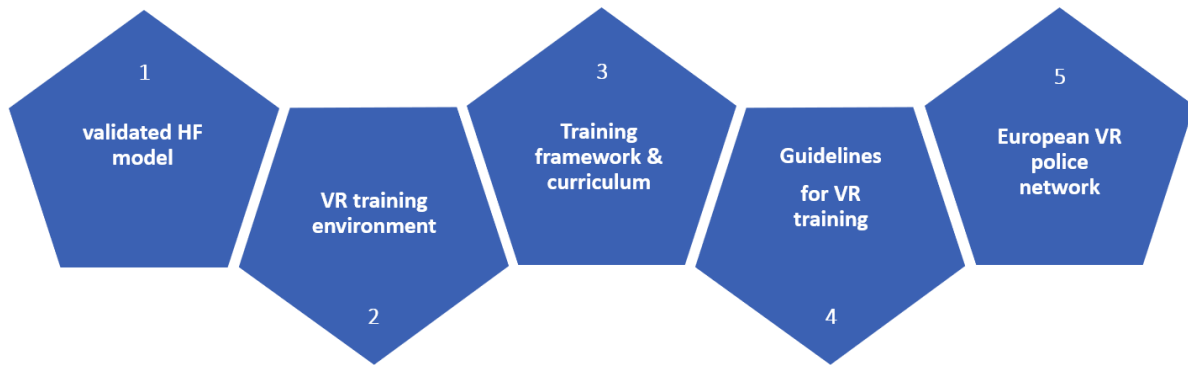


Figure 2. SHOTPROS objectives – overview.

1.3 Impact for LEAs

D7.5 impacts European LEAs in the following ways:

- Through evidence-based recommendations, LEAs have a manual on how to implement and govern VR training to supplement current practice
- Through evidence-based didactical guidelines, police trainers are guided on how to set-up, conduct and evaluate a VR training session to enhance the learning process of trainees

1.4 Impact on the security in the EU

D7.5 strongly supports the internal security strategy for the European Union (cf. Guideline VIII - A Commitment to innovation and training) in the following ways:

- Through increasing alertness on innovative, effective training concepts
- Through harmonizing the DMA-SR training for all European police forces
- Through standardisation of exchangeable practical toolkits such as VR implementation recommendations, and didactical training guidelines for trainers that guide European police forces and organisations in the use of VR, eventually leading to better trained police officers and thus a safer EU.

2 The SHOTPROS Final Training Curriculum

Policy-makers, training coordinators and trainers are together responsible for application of VR training. They need to explore how the VR training can be implemented successfully and effectively based on their expertise in police training and knowledge of (didactical) features of VR. Then, internal guidelines need to be set up and they are, together with the seven didactical concepts the base for future VR trainers to be considered for successful VR police DMA-SR training.

In the first part of the SHOTPROS VR Final Training Curriculum, we provide policy-makers and training coordinators with essential considerations to implement VR in current training. This section corresponds in content to the information described in the Meso level of the DMA-SR training framework in D3.3 and reiterates the information from the Meso level of D3.3 in a concise and accessible manner. For more details we regularly refer back to D3.3, but the information presented in this deliverable can also be read and understood on its own. We answer the questions below:

- Which training areas are useful to train with VR?
- VR training for whom and how to organize groups of trainees?
- What is the format of a VR training?
- How much VR training?
- Should VR training be given before or after real-life training?
- Which safety measures should be taken for VR training?
- Which logistics are needed for VR training?
- What are the tasks of the trainer in VR?

In the second part of the SHOTPROS VR Final Training Curriculum, we outline seven didactical concepts for trainers as a guide for successfully conducting VR training sessions to enhance the learning and DMA-SR behaviour of the trainees. Based on the training observations of good practices in the SHOTPROS Field Trials (see D7.1 & D7.2), the didactical guidelines have been significantly enriched compared to D3.3. This means that the concepts, based on the observed good practices in the Field Trials (see D7.2) and the theory in D3.3, have been translated into actionable and concrete didactical guidelines for police trainers. Alongside the enrichment of the written guidelines, highly informative videos have been added to each concept, easily accessible with a QR code and tiny URLs. In this way, trainers can, for example, consult information quickly and efficiently during a training session or consultation with fellow trainers and obtain the information visually instead of through reading a piece of text. The didactical guidelines can be used when designing or preparing VR training. They can serve

as a guide for trainers during VR training and they can form criteria to evaluate and monitor the didactical quality of VR training. The seven didactical concepts are:

- Is there a clear assignment?
- Is there a well-designed practice situation?
- Is there high-quality instruction?
- Is model learning used?
- Is there possibility for self-management of the learning process?
- Is there variation and differentiation?
- Is there constructive and motivation feedback?

2.1 Part 1: Recommendations for implementing VR training in current police curricula

Based on various qualitative and quantitative results from SHOTPROS HF studies and experiments (see D6.1) and the Training Framework (see D3.3), the information on the following pages provides recommendations on how VR training can complement and be integrated into current police practice. It discusses the usefulness of VR for police training areas and how VR can be implemented at a logistical level.

2.1.1 Which training areas are useful to train with VR?

VR is particularly useful for tactical training and perception and action training, such as exposure to armed perpetrators, tactical approach, room scanning, etc., and less useful for physical training, such as combat and fitness training. Table 3 shows an overview of the training areas and accompanying usefulness ratings (up to 5 stars) and associated observations and recommendations for VR.

Training Area	Usefulness	Observation and recommendation
Tactical training	*****	The possibility of quickly varying location and scenario context in VR creates the groundwork for the training of tactical strategies in many different situations, from training tactical basics to applying these basics in a car procedure scenario or AMOK situations (based on input from EndUser FeedbackWeek 2, see D6.1).
Perception and action	*****	<p>In real-life, trainers must adapt their training to the training location's infrastructure. VR does not have this limitation, making VR extremely useful for perception and action training (see D3.3 for more details). VR offers different environments where a trainer can adjust and create cues quickly and on the spot, such as breaking a window, adding a door or an extra bystander walking in from behind. The trainees must perceive and respond to the changes that the trainer makes.</p> <p>Training tactical strategies and perception and action seems more effective if the trainee already possesses basic skills, such as handcuffing and using a weapon (see D3.3 for more details).</p>
Law and regulations training	****	The after-action review (AAR) (visual debriefing of the training session) is an excellent VR-specific feature to provide feedback on information regarding law and regulation that cannot be monitored and reviewed in real-life training; for example, to provide information about correct hits after weapon use and how many civilians were flagged (i.e., were in the line of fire) and therefore endangered, which is important for law and regulations education (see D3.3 for more details).
Communication training	***	<p>VR is helpful for communication training because it allows quick customisation of the avatar's appearance (gender, skin, cultural aspects) and how trainees respond to and communicate with the avatar.</p> <p>A point of attention is that emotions must be appropriately interpreted. In VR, this is still a challenge. Where trainees see legs and arms moving, they do not see subtle differences in facial expressions, such as eye movements and human features. Trainees may make a different assessment of the situation if they cannot perceive these subtleties. It is recommended to work with a professional actor as a role-player to optimise the display of adequate emotions for role-played avatars (see D3.3 for more details).</p>

		<p>This topic was one of the major feedbacks during the EndUser FeedbackWeeks. Therefore, a concept regarding realistic behaviour of role-playing avatars and non-playing characters (NPCs) in the VR was included in the product backlog and is part of the requirements in D4.6. The additional experimental VR environment as part of the SHOTPROS results offered more realistic facial expressions by using meta-human features (see D5.1).</p>
Shooting and weapon handling training	**	<p>The AAR provides information about hit rates, shooting lines, cross-fire and other performance measures (see D7.6) that cannot be monitored easily in real-life, and makes VR useful for training positioning in reference to the suspect and colleagues when using weapons.</p> <p>VR and its current technology has shortcomings for training the technique/action of shooting. Exact tracking (which would be necessary for exact shooting like in a shooting range) is a trade-off regarding mobility, size of the training field and size and power of the VR backpacks. Pistol aiming is therefore often not precise, there is a delay in movement, and reloading the weapon is not completely realistic (input from EndUser FeedbackWeek 2, see D6.1). All feedbacks regarding this topic are also comprised by the product backlog and D4.6. Moreover, precise real-life shooting training is always executed with the duty-weapon to train the body memory and the “behaviour” of this unique weapon. This cannot and should not be done with VR. We do not see VR as a supplement for detailed technique training but as a training where different skills are combined, sometimes abstracted (e.g., less exact aiming) to follow the higher goal of scenario-based model learning and a focus on decision-making, communication, perception of threats etc.</p>
Physical training (combat, fitness training)	*	<p>All actions involving physical contact (e.g., handcuffing, controlling and restraining of suspect, use of weapon) are not suitable for VR training due to safety for trainees and fragility of materials and necessary real-life haptic experience. Feeling a real human trying not to be handcuffed is totally different than a virtual character or even a role-player and using VR tools. This type of actions during operation can only be a symbolic part of the VR training and have to be trained separately for gaining expertise.</p>

Table 3. Police training areas derived from usefulness ratings by police trainers. The usefulness scale specifies a range from 1 to 5 stars where 1 star indicates a minimal usefulness, and 5 stars indicates a maximal usefulness.

2.1.2 VR training for whom and how to organize groups of trainees?

Consider using VR as a teaching tool for trainees who already possess the basic skills, such as handcuffing and weapon use. Trainees need to possess the **basic skills** in order to engage in VR training meaningfully as the virtual environment is cognitively demanding as is (requires more mental effort than RL training, see D3.3). Adding the demands of learning entirely new skills in such an environment would be overwhelming and inhibit learning. Furthermore, having the basic skills enables trainees to use the skills in an integrated fashion in scenarios and not practice segmented skills only.

Depending on the goal of the training and the number of trainees (also compared to the number that resembles the real-life duty on patrol), trainees can take on various roles in VR: the officer, the suspect/role-player, bystanders, or a “ghost” observing the scenario.

To ensure sufficient active training time for trainees and avoid waiting time of trainees in larger training groups, trainees who have not been assigned an active officer role in the scenario can act as role-players. Using trainees as role-players allows trainees to experience a scenario and officer behaviour from a different perspective. This perspective allows the trainee role-player to provide specific feedback to the trainee that played the officer based on their experience of the officers’ actions.

Trainers can also give the additional trainees (those that do not have an active role in the VR environment) a specific viewing assignment using the external monitor.

Due to the specific AAR feature of VR, each training session lends itself to be set up in such a way that two groups can train simultaneously (i.e., while one group performs a scenario in VR, the other group receives feedback at the AAR station; when both groups are finished, they switch tasks). In this set-up, one ideal group consists of:

- 1 operator (depending on the VR provider)
- 1-x role-player (depending on the scenario needs)
- 1 trainer
- 2 - 4 trainees

The number of trainees should resemble the real-life duty on patrol. For example, in Berlin, first responder police typically patrol with a group of three officers; therefore, during the FTs in Berlin, they also trained with three trainees in the VR. In North Rhine Westphalia, it is typical to patrol with two officers plus two more for reinforcement, so we trained in this set-up. In general, the number of people in training must fit the number of available smart vests

and computer power to track the smart vests. At the moment, we have experimented with up to 8 smart vests within the SHOTPROS VR solution.

Trainers should ensure that trainees have an active role in the scenario and avoid waiting times for trainees without any tasks. Therefore, the attending groups and the planned scenarios should fit together and be planned properly in advance. It is important that the trainer prepares and provides the trainees with a training schedule in advance, which also takes into account the group size and roles.

2.1.3 What is the format of a VR training?

Based on experiments conducted within the SHOTPROS field trials and HF studies, a VR training typically comprises of the following training activities:

- **Preparation** (putting gear on, calibrating, VR tutorial, material check)
- **Instruction** (instruction of exercise, role-player and officer, tutorial scenario)
- **Execution** (actively engaged in a training scenario as a role-player or officer)
- **Feedback** (from the trainer, from other trainees, self-reflection, AAR).
- **Waiting** (trainer is busy, operator is busy, social time)

Figure 3 can be used by trainers to plan their training, or to give them an indication of time that is normally spent on training activities in VR, based on the experience of 1.5-hour VR training sessions conducted during the TrainCompar study (see D3.3).

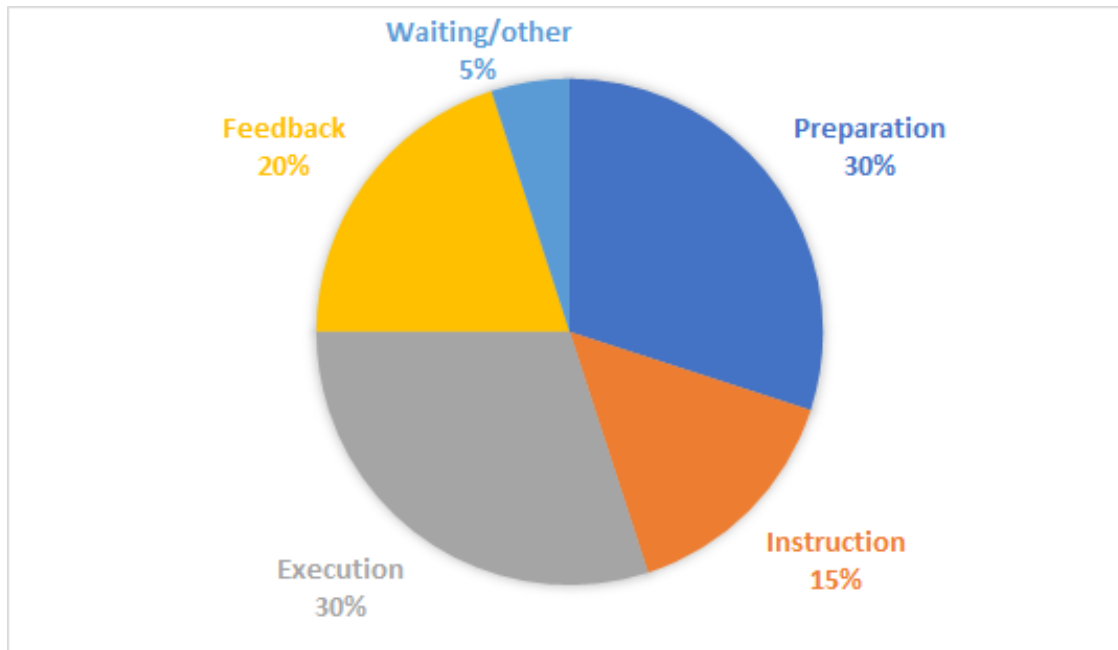


Figure 3. Time spent on training activities in VR, as recorded in 1.5-hour training sessions during the TrainCompar study (D3.3), displayed in percentage of total duration of the VR training session.

It is imperative to use a strict protocol to reduce trainees' preparation time and waiting time (see also D3.3, section 3.3.3 "Training Instruction"). In addition, LEAs can consider having a familiarisation session for the preparation part in VR (tutorial scenario) to get used to handling objects or the VR environment in general) to enhance trainees' focus on execution instead of the novelty of the VR material and habituation. In the course of the EndUser FeedbackWeeks (see D6.1), the tutorial scenario was very valuable and thus was adapted to the LEA needs and was kept in use in the field trials (see D7.2).

Be aware of the higher preparation time that VR training requires at the beginning until all get used to the new methods and the knowledge is settled. When planning VR training blocks, the duration of a session should be a minimum of 1.5 hours to provide the training time needed to ensure sufficient training of DMA-SR behaviours.

Allow trainers to try out and familiarise themselves with the VR set-up beforehand or attend a class taught by an experienced trainer to reduce preparation time in a VR session (train-the-trainer principles).

Just as an example, *figure 4* shows the planning of timeslots for VR training during the first two days of the **Field Trials in Berlin**. The planning shows that on the first day of the Field Trials, a large Train- the-trainer block was conducted to introduce the new trainers to VR training. The planning also shows that the timeslots have a small overlap. This way, a new group of trainees could prepare and put on the VR suit while the previous group concluded with the feedback in the AAR. This was done to leave as much actual training time as possible.

Time	Monday	Tuesday	
08.00-08.30	Train the Trainer	Introduction and VR suit dress-up	
08.30-09.00		VR-Training	
09.00-09.30		VR-Training	
09.30-10.00		AAR & dress-down	Introduction and VR suit dress-up
10.00-10.30			VR-Training
10.30-11.00			VR-Training
11.00-11.30			AAR & dress-down
11.30-12.00			
12.00-12.30			
12.30-13.00			
13.00-13.30	Lunch Break	Lunch Break	
13.30-14.00			
14.00-14.30	Introduction and VR suit dress-up	Introduction and VR suit dress-up	
14.30-15.00	VR-Training	VR-Training	
15.00-15.30	VR-Training	VR-Training	
15.30-16.00	AAR & dress-down	AAR & dress-down	

Figure 4. Planning of timeslots for VR training during the first two days of the Berlin Field Trials.

Execution and feedback typically form repeating loops within a training session to train different levels of stress or provide scenario repetitions with variations. The trainee's experience of VR training seems to be strongly related to the amount of scenario variation. Hence, focus on creating sufficient variation in a scenario and from repetition to repetition within the time available. For achieving this, the Real-Time VR Trainer Dashboard (see D4.5, D7.6) will be a very useful tool, but also the RAT (see D4.7, D7.6) can help to decide on variations.

Training time is a precious asset amongst European LEAs, so it is essential to achieve as much execution time and learning options as possible in the available time. If LEAs plan to set up a training with a specific learning objective (e.g., tactical training, communication training), LEAs should consider VR as the most useful training tool for that particular training if it coincides with a high usefulness rating in VR (see *Table 3*).

A clear advantage of VR-based feedback is that there is no discussion on what did or did not happen, as what happened is readily available via video replay in the AAR from almost any perspective. This implies feedback and reflection can immediately address **why** something happened or was done. It allows trainers and trainees to focus on learning from the situation instead of debating it. This may be particularly helpful in groups of trainees with some resistance to feedback or learning.

VR offers unique additional feedback opportunities such as playback from different perspectives, pausing and time stamping (by setting bookmarks of) critical moments, and reviewing performance indicators (see D7.6 for more detailed information on the use of these technical features). Trainers should take time to become competent in using the AAR options so they are self-efficacious in using the system when they see fit and are not held back by insecurity or lack of competence.

2.1.4 How much VR training?

Because training practices across LEAs in Europe differ in volume (duration, frequency, and components) (see D3.3 for more details), the question how much VR training trainees should receive cannot be answered unequivocally. We can, however, give a few recommendations regarding duration and timing of VR training.

The duration of a high-quality and effective VR training session should be a minimum of 1.5 hours of total training time (including preparation and instruction) to ensure sufficient time for execution and thus training of DMA-SR behaviours in VR (see also D3.3, *Table 6* for more

detailed information). To make extensive use of the VR AAR tool, the duration of a VR session might need to be extended to a minimum of 2 hours.

There are indications to implement VR training more frequently at the end of an existing training program because more experienced trainees are more engaged and have a higher learning transfer (see results Rotterdam, D3.3, *table 12*). Furthermore, it is easier for experienced officers to combine different skills in scenario-based approaches like in VR (see also 3.1.2 “VR training for whom and how to organize groups of trainees?”) than for those where basic-skills are not settled yet.

When police officers experience VR training for the first time, they invest more mental effort than in real-life training (Kleygrewe et al., forthcoming). Police officers with previous VR experience and/or gaming experience suffer less from this higher mental load. Therefore, familiarisation with VR may free up mental capacity to train in VR. More frequent exposure to VR (if training time allows) may benefit the efficacy of VR training because officers become more adapted to being in a VR environment and can focus on the training aspect

As VR training can be as exhausting as physical training, trainees should be prepared to bring enough water and clothes to change into after training. Having mints or gum available for participants to chew on may help in case of (mild) cybersickness.

2.1.5 Should VR training be given before or after real-life training?

At this point, there is no substantial evidence that conducting VR training before or after real-life training affects training activities or quality of learning in VR (see results TrainCompar in D3.3). When planning to set-up a VR training, police practitioners can develop a training block of VR- and real-life training independent of order and based on the availability of training spaces and resources. We suggest circuit type of trainings to save on resources. For example, a training day that includes physical sessions, a law and regulations lecture and VR training on the same location to save time of the trainees.

2.1.6 Which safety measures should be taken for VR training?

Most “normal” safety precautions (as in real-life police training) apply to VR training. Well established rules of conduct for real-life training, such as respectful interaction with fellow trainees and "no-play" provisions should be used for VR training. Additionally, there are some VR-specific points that policy makers should consider when it comes to physical and

psychological/social safety of trainees. We divide these into physical safety measures, psychological safety measures and privacy safety measures.

2.1.6.1 *Physical safety Measures*

- As the physical aspect is less present, VR provides a safe environment to train in high-risk situations with minimal risk of physical harm (injuries) to trainees (compared to FX training, for instance).
- Motion sickness can lead to dropout of trainees in training and negative experience with VR (see results Twente study, D3.3, Table 12; evidence from EndUser FeedbackWeek 2, see D6.1). Specific protocols should be developed, possibly in collaboration with the VR provider (see requirements in D7.6), to reduce motion sickness and handle motion sickness when it occurs.
- Hygiene should be considered because trainees wear VR suits while being physically active and possibly sweating a lot (evidence from EndUser FeedbackWeek 2, see D6.1); specific protocols (such as using hygienic and odour-eliminating sprays like myrazine) should be developed to ensure proper hygiene measures.
- When using the live monitoring within the Real Time VR Trainer Dashboard (see D4.5, D7.6) during a VR training session, the possibility exists that trainers or operators might notice abnormalities in heart rate (irregular or too high) or chronic stress (low HRV baseline levels) of trainees. In cooperation with training coordinators, policy-makers should develop a protocol that addresses incidental medical findings and how these will be handled a) if noticed during a training session and b) if noticed after a training session, indicating possible medical risk to the trainee.

2.1.6.2 *Psychological and Social Safety Measures*

- VR can increase training safety by monitoring trainees using VR features such as the in-action monitoring (IAM), which connects to the Real Time VR Trainer Dashboard (see D4.5) and AAR (see D7.6). These functions allow trainers to perform repetitions and manipulate the complexity of scenarios to ensure that trainees end their training with positive experiences (i.e., resolve a situation correctly).
- Trainers need to ensure that training, in particular certain scenarios, are not overwhelming and cause information overload for the trainee. The risk assessment tool (see D4.7, D7.6) offers trainers a tool to familiarise themselves with trainees' possible

previous encounters to avoid further triggering of incidents in training (see D2.3, section 4.2.2). The Trainer Dashboard offers options to assess and directly de- or increase stress cues (see D4.1) during the training.

- In training, trainers need to ensure that the level of training does not exceed the trainee's development phase. This can be achieved by properly using the risk assessment tool (see D4.7, D7.6) and the Stress Level Assessment panel of the Real-Time VR Trainer Dashboard (see D4.5, D7.6) to properly steer the scenario complexity.
- Gamification may increase the chance for compromised ethical/moral behaviour of trainees and could reduce the focus on the learning objective in VR training. Gamification is not well-appraised in the context of police training (EndUser FeedbackWeeks 2 and 3). Thus, trainers need to pay particular attention during the VR training instruction to avoid gamification and monitor trainees' behaviour during the use of VR to eliminate gamification behaviour as soon as it arises.
- Through the proper steering of the course of a VR scenario and possible controlled manipulations of stressors and complexity, VR training offers the possibility for safer post-traumatic stress disorder (PTSD) reintegration (when compared to real-life training). Using the VR results dashboard for measuring and reviewing training session performance (see D5.4), experienced VR trainers can ensure a safe training environment for police officers who have suffered from PTSD syndrome and are working towards reintegration.

2.1.6.3 Privacy Measures

- When the VR gear or any placement of sensors requires (partly) undressing, a dressing area should be available that provides privacy for trainees.
- VR systems offer a great possibility to store valuable training information as VR features (IAM, AAR) are able to monitor how trainees move around in the virtual environment, store training data, and monitor progress and performance over time. These possibilities demand that a policy on data storage (see D8.5) of VR training output is in place for VR training.
- LEAs that adopt VR training in which data is recorded need to develop and implement policies on the anonymity of data, the longevity of data storage and access to the data (see D3.3 and D8.5 for more details).
- LEAs that adopt VR training in which individual non-anonymous data can be displayed in the AAR or IAM need a code of conduct for trainers and trainees on how to use this data

respectfully. For example, if high-stress levels are displayed in an individual, this may lead to stigmatization or even bullying if not handled properly. Individual, non-anonymous data of physical state may be considered a private issue for trainees and might only be discussed with a trainer and not 'in public' with peers. The option to turn on and off might be an easy solution so that LEAs can comply with their own code of conduct considering this data (EndUser FeedbackWeek 2 – D6.1)

- For the use of a VR system that displays or stores potentially sensitive data, make sure to keep the system disconnected from public channels (i.e., use of a free radio channel, stand-alone system with no Wi-Fi, or Bluetooth access).

2.1.7 Which logistics are needed for VR training?

2.1.7.1 Location

After experimenting with the location of the tools and features during the SHOTPROS field trials (see D7.2) and to ensure efficiency, the VR training location should be separated into three distinct areas:

1. **Preparation:** This area should contain the VR suits and equipment (like tactical belt, power stations for gear, etc.) and is solely dedicated to preparing the trainees for VR. If certain body sensors (as used in the SHOTPROS VR solution) are part of the training, a mobile wall has the advantage to provide a more private area to get the sensors attached to the trainee's body, as the sensors need to be worn on bare skin and thus putting them on involves undressing.
2. **Execution:** This area (e.g., a gym hall) should contain the floor space suitable to the scenarios planned and meet the technical requirements to accommodate the VR system (see D7.6 for technical requirements and a schematic presentation of the training pitch). This area is dedicated to the calibration of the VR system and execution of the training scenarios. This also includes space for the operating station for a technical operator of the system. To make IAM available, a separate (touch) screen that visualises the Trainer Dashboard (see D4.5 & D7.6) and provides all relevant control options for a trainer should be placed close to the training field and also close to the operator to reach when needed. This station can also act as a dispatcher for the trainees (via radio) and so the trainer can follow the scenes both in real life and in VR (see Figure 5) and also react directly by using the Trainer Dashboard or instructing the operator for more detailed adjustments.



Figure 5: The same training scene in VR (via screen) and in real life

3. **In- and After-Action monitoring:** This area should contain sufficient space for the trainer and trainees to monitor the scenario during action (IAM) for those who are not in action at the moment and also for trainer and trainees to view the screen after the execution for feedback in a after-action review session and debriefing of the training – this section is ideally in a separate room so the next group can already start with calibration and the ones receiving feedback have a more private and sound-controlled environment to engage with the training and is therefore solely dedicated to re-viewing the training.

2.1.7.2 Role-Players

Depending on the learning objectives and the selected scenario, a role-player might be necessary to enrich the realism of a scenario. Although VR brings the big advantage of using non-player characters (NPCs)¹ for simple roles in the scenario or adding realism by surrounding bystanders, executing a VR scenario training with NPCs only might reduce the training areas that are suitable for VR as the interaction with NPCs is limited and not all trainings can be done with this limitation (also see D7.6 – detailed description of NPC requirements for a VR solution). Multiple options for role-players exist:

- Trainers act as role-player
- Trainees act as role-player
- (Professional) actors act as role-players

Furthermore, it must be clarified if and to what extent the selected scenario needs a dispatcher to whom the trainees can communicate during the training. Depending on the extent of dispatcher communication (more for extensive scenarios and less [dispatcher

¹ NPCs are computer animated characters that react and behave either by definition or by control of an operator or the trainer, but have limited artificial intelligence and therefore cannot react on detailed human behaviour

information via radio only] for simple scenarios) it can be decided if the trainer takes over the dispatcher communication or another role-player is needed for this purpose or only pre-recorded radio-advises are played to the trainees

To establish a reliable training environment with reliable and recurring role-player reactions for all trainees of the training day, the role-player needs detailed instruction and options to react to certain trainee actions. This supports the notion of using a trainer or at least an experienced officer for role-playing as this person can – in real-time and on the fly - change the interaction with a trainee and react to their behaviour to increase the learning effect. In some field trials fellow trainees were successfully used as role players. They received certain instructions by the trainer beforehand (like: wait until at least these three instructions were made by the officer towards you to react) or even during the acting by either direct voice transmission (channels that can only be heard by dedicated persons) or simple gestures.

When using role-players throughout multiple training sessions on the same day, it must be considered that acting as a role-player in VR requires a large amount of cognitive effort. Thus, when setting up a VR training with role-players (other than trainees of the same session), it should be ensured that a) role-players have a sufficient break between sessions and/or b) multiple role-players are available to take turns. For a specific description of the role of the role-player in VR, see Table 13 in D3.3.

2.1.7.3 Operators

The operator of a VR system is responsible for the technical guidance of the VR set-up and the scenario. In general, the operator of the VR system is provided by the VR system provider. Alternatively, depending on the contracting with the provider or as a long-term goal, an experienced trainer can operate as an operator after receiving sufficient training in using the software (including hardware and power management) and managing the course of the scenarios, and playing the dispatch person etc.

Regarding language, the operator must understand the language (including specific jargon) the trainees use while acting in the VR to react to their commands faster and provide more realistic reactions of the NPCs and the environment itself. Hence, operators and trainers need to be familiar with the process of the live-editing of a VR scenario (see D4.5, D7.6).

Prior to the training session, operators should communicate the possibilities the VR live-editor offers trainers in changing and steering the context of the scenario so that trainers know what they can and cannot control during the course of a scenario by themselves. For a specific description of the role of the operator in VR, see D3.3, Table 13.

2.1.8 What are the tasks of the trainer in VR?

Evidence (from the TrainCompar study, see D3.3) suggests that the influence a trainer has on training is even more prominent in VR compared to real-life training. A trainer should be experienced in providing scenario-based training AND possess some level of technological skill. Input from trainers (see TrainCompar study, D3.3, Table 12) indicates that compared to real-life training, more technical knowledge (such as basic knowledge of computer controls) and skills (such as handling the controllers of the VR AAR) are needed from trainers. Trainers need to be prepared and trained to master the (technological) skills for VR training, which takes time and may lead to specific choices for trainers that are technology-wise-open-minded (i.e., have an affinity for technology such as playing video games or having worked with other police or military training simulators before and are in general open for innovative technological approaches). Compared to real-life training, VR offers the opportunity to steer the development of a scenario on the fly without interrupting the course of the training (see Real Time VR Trainer Dashboard 4.5 and In-action Monitoring (see D7.6). To ensure that the scenario remains realistic and supports the trainees' learning experience, the trainer and operator must cooperate and communicate well during the steering of the scenario. Prior to the training session, trainers should communicate the training aim and learning objective with the operator to ensure that the scenarios and NPC reactions are in agreement with the aim and objective of the training. To aid communication with the operator, short cue words (selected prior to the training session) can help steer the scenario together (e.g., "360" to send in an unexpected NPC from behind when the officers do not check their backs).

In Table 4, the tasks of the trainer in VR training are summarised. Trainers should make sure they are proficient in these tasks and prepared to take them on in the training session. Some of these tasks are similar to real-life training (upper part of Table 4) and as such pose no new challenges to trainers, just a different training mode. Other tasks are specific for VR training (lower part of Table 4) and will require familiarization or training of trainers, and may place extra mental load on trainers.

Trainers' tasks in VR that are similar to real-life training:
Providing clear assignment of the training: learning objective
Providing instruction for the exercise and scenario instruction to officer(s) and role-player(s)
Checking material and equipment, such as weapon change and personal property of trainees
Providing a clear start and end point of a scenario
Monitoring trainee execution and progress of scenarios
Providing feedback after scenario execution
Trainers' tasks that are specific to VR training:
Providing guidance and support to the operator while trainees put VR gear on
Providing guidance through the tutorial scenario
Selecting a training environment and scenario that fit the learning objective: make use of the risk assessment tool (see D4.7, D7.6) and provide information material before the training to the trainees, role-players and fellow trainers
Cooperating with VR system operator and/or using the Real Time VR Trainer Dashboard (see D4.5, D7.6) to adjust scenario, stress level, and tools
Changing the behaviour of the role-player during the scenario by guiding them directly via headset without trainees being able to notice. NPCs that are animated and controlled automatically need to react more realistically according to feedback from LEAs. Therefore, also direct reactions executed by the trainer in the Executive Control Station are a necessary requirement towards a VR solution and offer the trainer direct and indirect steering of the scenario by changing the NPC reactions (see D4.6, D7.6)
Operating and analysing with the AAR system and using it properly (see didactical guideline: <i>Is there constructive, motivating feedback?</i>)

Table 4. Tasks of trainers in real-life (top) and VR training (bottom).

When conducting a VR training, trainers have various tools available to support them. Listed below are tools that trainers should familiarize themselves with before they conduct a VR training, and that they should use in accordance with the didactical guidelines provided later in this deliverable:

- **Risk Assessment Tool** to select proper stress-level for trainees (see D4.7 & D7.6)
- SHOTPROS VR solution to decide on scenario and environment and execute the training (WP5)

- **Real Time VR Trainer Dashboard** for live performance assessment (see D4.5, D5.4 & D7.6) including the **Stress Cue Control Panel** within the solution to adapt the scenario according to performance and stress-level (see D4.5 & D7.6), the **Stress Level Assessment Panel** (see D4.5 & D7.6) to assess the level of stress by each trainee (measured by body sensors and calculated by the SHOTPROS VR solution) and the **In-Action Monitoring Panel** (see D4.5 & D7.6) to have an overview on current performance indicators.
- **After-Action Review** (see D4.6 & D7.6) to execute a debriefing of the training session.

If training is set up with two subgroups with two trainers (see 3.1.2 “VR training for whom and how to organize groups of trainees?”), the roles of the trainers can be set-up as follows: As soon as the first training group finishes the execution of a training, this group moves on to the final AAR. At this time, the next group should already start with the execution to save trainee-time. This implicates that there is a **trainer for each group within the VR** context.

Thus, the roles of the trainer are to **supervise** and **direct** the **preparation** and **execution** and then supervise and execute the **AAR feedback phase**. Ideally, both is done by the same trainer for the same group of trainees as the trainer will already be familiar with the individual trainees and their performance within the training and is aware of what needs to be addressed in the AAR after the execution.

2.2 Part 2: Didactical Guidelines for VR Training

In the following, we outline **seven didactical concepts for high quality training** and explain how to apply these didactical concepts in VR training by

1. stating the relevance of the concept for training.
2. providing a QR code and tiny URL that links to an information video about the didactical concept.
3. providing actionable and concrete best practices to apply the concept in VR training.

 European Commission, Horizon 2020

Didactical Guidelines

Is there a clear assignment?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: Good practices for a clear assignment

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is there a clear assignment?

The training assignment communicates the purpose and relevance of the learning objective to the trainees. Providing clear assignments motivates trainees to engage with the training and provides clarity on the learning goals and enhances the training effects.

For relevant information on how to apply the didactical concept of clear assignment in VR, **watch this information video by scanning the QR code or clicking the link.**



tinyurl.com/fy2mxk4y

Good practices for a clear assignment

- The trainer states the learning objective and explains why this learning objective is relevant for the officers.
- The trainer discusses with trainees how the learning objective aligns with their training schedule.
- The trainer explains what the goal is that the officers need to achieve in the assignment. The trainer should be clear about WHAT the officers need to achieve, not necessarily HOW they need to achieve this goal.
- The trainer explains the goal in such a way that the officers would be able to evaluate afterwards if the goal was achieved or not. In other words, officers can answer with a yes or no to the question whether they have completed the assignment. Of course, the quality/efficiency/etc. can be discussed in more detail and feedback can be provided on by the trainer, but whether the assignment is completed or not should be unequivocal.
- The trainer explains the benefits and limitations of training in VR to the trainees (e.g., the use of various avatar skins, no need to dress role-player or trainees in a certain way). The trainer takes into account that trainees may initially struggle with the novelty of the VR tool itself.
- The trainer asks trainees to repeat the assignment in their own words to check for understanding before they start.
- The trainer makes use of different VR scenarios, while the training assignment remains the same. The trainer can use risk assessment tool (see D4.7 & D7.6) to create different VR scenarios that align with the assignment. For instance, the assignment is the same

every time: “find the armed suspect”. The trainer can create different scenarios for this assignment:

- The trainer takes advantage of the flexibility of the virtual environments and uses each repetition a different environment with one armed suspect (an apartment, a furniture shop, an open square, an office space, a school etc.)
 - The trainer varies in complexity of the scenario with the armed suspect (few or many people in the environment, transparent space or space with many obscured/hidden areas, suspect armed with a knife or with a machine gun, many stress factors (children present, dark space, loud noises) or no additional stress factors, etc.
- Trainer asks trainees to repeat/recall what their assignment was before starting the debrief/feedback.

Didactical Guidelines

Is there high-quality instruction?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: Good practices for high-quality training instruction

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is there high-quality instruction?

Good training instruction provides trainees with a task goal and sets the tone for the training. Through concise instruction, the trainee obtains information about the nature of the training and the relevant points that he or she needs to pay attention to. The trainer emphasises the result of actions, uses metaphors and makes deliberate choices to use implicit instruction or explicit instruction. Good training instruction has been shown to facilitate skill acquisition (Hodges & Franks, 2002).



For relevant information on how to apply the didactical concept of high-quality instruction in VR, **watch this information video by scanning the QR code or clicking the link.**

tinyurl.com/2p89jn92

Good practices for high-quality instruction in VR-training

Instructions to prepare for VR training

- The trainer provides a clear overview of safety measures in VR training (e.g., physical contact is not possible, a code word to immediately stop a scenario and possibilities of motion sickness).
- The trainer gives trainees a clear overview of what to expect from a VR environment and what tools are available in the VR environment (e.g., NPCs options and how to speak to them, role-player and how to interact with them).
- The trainer provides trainees with step-like instructions on how to put the VR gear on. The gear-specific instructions should be specific and explicit when needed. For example, when putting on the headphones: *“put your hand in this position and press on until you hear a click”*. These measures can be reduced depending on the expertise level of the trainees.
- The trainer asks the trainees to help each other with the set-up of the VR gear rather than prepare individually.
- The trainer asks the trainees to line up next to each other (with room to move). The trainer then gives the trainees the signal to start a joint calibration process.
- The trainer asks trainees to indicate if there are technical problems with the VR material after the calibration, for example if they have no image or the calibration does not seem to have worked (no realistic movement). If so, the trainer asks the trainee to communicate the problems to the VR operator.

- The trainer explains the purpose of the instructional scenario (tutorial) if included in the training structure.

Instructions during the VR training

- The trainer gives clear commands to trainees when they can put on and take off the visors and headphones to ensure that trainees can follow instructions.
- The trainer provides trainees with training instructions about the structure of the training, learning objectives, and what level of difficulty they can expect.
- The trainer briefs trainees with general dispatch information but does not give away how to handle the situation (*"proceed according to what the situation calls for"*).
- The trainer keeps the relevant points that trainees need to pay attention to during the scenario very limited. The trainer gives the trainees concise and single points to focus on, such as "avoid crossfire" or "make sure you scan the entire room by running the walls" or "as a group, always keep your six". As a general rule of thumb no more than three points of attention should be given in training, but as the novelty of the VR training tool requires a large amount of the trainee's mental capacity in VR even down tune to one or two.
- The trainer tailors the instruction to the capabilities and developmental stage of the trainees. The trainer builds up the instruction in terms of the number of points on which the trainees must concentrate during the scenario. For example, start with one or two focus points (make sure you scan the whole room by running the walls" and "as a group always keep your six"). If the trainees are successful, the trainer can give the trainees a new focus point ("avoid crossfire"), etc.
- The trainer uses the possibilities of VR to give implicit instruction rather than a specific and step-by-step verbalisation of what to do or what went right and wrong. The trainer can build a self-explanatory scenario, giving clear cues in VR (as is done in gaming) and punishing/rewarding in the VR scenario for doing wrong/good (e.g., having an NPC or role-player come from behind if the group does not keep a 360-degree overview).
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.
- The trainer ensures the role-player's instruction is not heard by trainees to prevent them from already knowing what is going to happen

- The trainer gives the role-player instruction according to the performance of trainees in previous scenario(s).

The following guideline only applies if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant instructions or cues to trainees during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.

 European Commission, Horizon 2020

Didactical Guidelines

Is there a well-designed practice situation?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: Good practices for a well-designed practice situation

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is there a well-designed practice situation?

In police training, a well-designed practice situation is defined by the level of realism it offers to the trainee. The practice situation should therefore invite realistic stress, present a realistic problem, and provide room for realistic solutions. The practice situation should be aligned with the training objective and “invites” trainees into the right learning activities. A well-designed practice situation has been shown to enhance transfer of knowledge and performance under pressure (Nieuwenhuys & Oudejans, 2011; Oudejans, 2008; Oudejans & Pijpers, 2009).



For relevant information on how to apply the didactical concept of a well-designed practice situation in VR, **watch this information video by scanning the QR code or clicking the link.**

tinyurl.com/ycxty7ad

Good practices for a well-designed practice situation

- The trainer checks before using VR if there are any arguments against using VR for the learning objective or that other training methods have clear benefit over VR. For instance, if the intention is to include physical contact, handcuffing, training of communication with micro expression, a different training tool would support this practice better. Is the goal to bring together and apply different skills in one scenario and to learn tactical behaviour, or if the trainees would benefit from quick variations in training, then VR might be the ideal solution to go for.
- The trainer selects training environments in VR that trainees may encounter on duty (realistic environment).
- The trainer selects scenarios in VR that present tasks and challenges that trainees may encounter on duty (realistic problem).
- The trainer ensures that in VR trainees can execute their tasks and find solutions to the challenge that are similar to tasks and solutions required on duty (realistic solutions).
- The trainer ensures that trainees have access to the same tools as in real-life, for instance, if a trainee carries a taser in real-life, the trainee should be able to carry taser in the VR belt as well.

- The trainer ensures that the number of trainees in a team is representative for the task and realistic for real-life performance (e.g., by how many trainees are the tasks and procedures expected in the VR scenarios normally performed in real-life)?
- The trainer ensures that the solutions provoked are as realistic as possible and achievable in VR. For instance, having a role-player acting as a suspect and giving the instruction to use physical force or resistance would not be useful as this requires a solution that cannot be performed by the officer in VR such as self-defence and physical arresting skills.
- The trainer selects scenarios according to the experience and level of expertise of trainees, properly scaffolding learning experiences to fit the level of the trainees. Clearly, special forces will work with more complex scenarios than police academy recruits, and the aim should be to practice near/around the zones of proximal development of the trainees.
- The trainer checks whether certain pitfalls of VR can be avoided in the training; for example, are stairs a necessary part of the training? And is it necessary that doors are closed in a VR scenario or can they already be open? (Since executions of the stair movement and opening doors are not yet experienced as realistic and natural by the trainees).
- By controlling or directing the responses of role-players and NPCs on the fly and in correspondence with the behaviour of the trainee, the trainer can foster trainees' beliefs in their capabilities to perform an action successfully. For instance, when the trainee performs well, make sure the role-player or NPC rewards the behaviour of the trainee thus providing the experience of success to the trainee. If trainees consistently fail, and the trainer fears that motivation and confidence will be lost in trainees, they may choose to simplify the scenario or adapt behaviour of the role player/NPC to pick trainees motivation back up again.
- The trainer avoids familiarising the trainees with the training environment, since in reality officers constantly encounter new and unfamiliar situations and it is important for the transfer of skills that the skills are constantly applied in new contexts. Therefore, the trainer adapts the scenario and the environment from repetition to repetition (e.g. from an outdoor scenario in the car park in daylight to an outdoor scenario on a busy road at night; placing cars and people can be done quickly by the VR operator).
- The trainer ensures that no repetition of a scenario is exactly the same as the previous since in reality no situation is the same as another. Therefore, the trainer adjusts role-

player instructions from repetition to repetition (e.g., instructing the role-player to act with weapon in one scenario and without a weapon in the next repetition).

- By using for example the in-action monitoring tools, the trainer makes a quick analysis of what is needed in the next repetition or practice situation depending on the trainees' performance. The trainer then adapts the scenario (the environment, the behaviour of the role-players or NPCs, the assignment for the trainees, etc) to meet the needs. For example, if the performance of the team shows the trainer that the trainees do not maintain a 360 overview of the situation while processing, the next environment, the behaviour of the role-players or the assignment should force the trainees to better maintain their 360 overviews. For example, by placing trainees in an area where threats can come from all directions, by placing NPCs in places that they would typically miss if they were sloppy with the 360 view, etc.
- The trainer ensures that the practice situation forces or invites the trainees to act in a certain way, without the need for explicit instruction. For example, a scenario where a perpetrator harms an individual until the perpetrator is stopped forces the trainees to speed up. Or if the environment is very cluttered (lots of people, stuff or spaces) it forces the trainees to scan the environment in a very focused and structured way.

 European Commission, Horizon 2020

Didactical Guidelines

Is model learning used?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: Good practices for model learning

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is model learning used?

Model learning refers to a teaching strategy that uses demonstration as instruction for skills or movements. The trainer, a peer, or a video or picture is used as a model that shows possible solutions, decision-making and acting, and skill execution. The learner closely watches the model to acquire the modelled behaviour (Gould & Roberts, 1981). Model learning has been shown to facilitate skill acquisition, retention, and motor learning (Hebert, 2018; Hodges & Williams, 2007).



For relevant information on how to apply the didactical concept of model learning in VR, **watch this information video by scanning the QR code or clicking the link.**

tinyurl.com/bd6haaxc

Good practices for model learning

- The trainer makes use of trainees as peer observational models (instead of solely relying on expert models).
 - For instance, during a training with four, two trainees are executing the training scenario in VR while the other two trainees can observe the performance on an external screen (AAR) using various viewing perspectives and a variety of abstract performance indicators (e.g., line of fire, movement paths, field of view, performance statics).
 - For instance, the trainer asks the trainees to designate a commander within the group who will lead the scenario execution and AAR. By having different commanders within the group during the course of the training, trainees can learn from each other's approaches and operating methods.
 - For instance, one of the trainees serves as a peer model on how to take off the gear in a procedural fashion (step-by-step).
- The trainer gives trainees a clear and specific viewing task related to the training or learning objective. For example, trainees may watch the execution of a scenario in three different situations (e.g. observing on the AAR screen while others are training, observing as "ghosts" in the VR environment while others are training or during a joint after action review). In all three situations, the trainer should give the trainees a clear and specific viewing task (e.g. instruct them to watch for decisive DMA moments; or evaluate a particular tactical skill; or observing a particular member of the group). This increases focus, steers the direction of the model's learning and ensures that the trainees observe the model's behaviour.

- The trainer uses the AAR as video feedback to allow the trainee to learn from their own implementation as a model.

The following guideline applies only if the trainer is wearing a VR suit:

- The trainer serves as an expert model for demonstration of certain skills or behaviours in the VR environment. The trainer can demonstrate sub-skills or sub-movements acting visible in the virtual environment.
- The trainer uses the VR “Ghost Mode” (see D7.6). Trainer or trainee can actively be part of the virtual environment as a “ghost” and observe the other trainees’ performance in the scenario without being visible to them.

 European Commission, Horizon 2020

Didactical Guidelines

Is there variation and differentiation?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: Good practices for variation and differentiation

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is there variation and differentiation?

Variation refers to the variability in a training environment or task (often from practice trial to practice trial) *without* making it harder or easier. Variation allows the learner to explore various movement solutions for achieving a goal. Differentiation refers to the variability in a training environment or task *with* the intent to make it easier or harder. Differentiation allows the trainer to adapt the training environment to the group level or to accommodate learning for trainees with varying levels of skill. Including variation and differentiation into a training environment has been shown to enhance exploration, skill acquisition, and transfer of learning (Wulf & Schmidt, 1997; Newell & McDonald, 1992).



For relevant information on how to apply the didactical concept of variation and differentiation in VR, **watch this information video by scanning the QR code or clicking the link.**

tinyurl.com/bdhj2jys

Good practices for variation and differentiation

- The trainer ensures that they have a predetermined selection database of VR environments (e.g. a minimum of three different virtual environments to vary easily and quickly in practice situations).
- To achieve variation and create a new practice situation, the trainer changes the context of the virtual environment for each repetition:
 - Through environmental changes: location variation (an apartment, a furniture shop, an open square, an office space, a school etc.) and additional objects in the environment, etc.
 - Through different starting points for trainees and role-players in the same virtual environment: For instance, the trainees start in the same building in one repetition at the main entrance and in the next repetition they start at the back entrance and the position of the role-player is in the first repetition in the kitchen and in the next repetition in the living room.
- To achieve differentiation, the trainer varies the level of complexity per repetition:
 - Differentiation through NPC: the trainer changes NPC level of aggression or changes their appearance, few or many perpetrators NPCs but also bystanders NPCs in the environment, NPCs with harder to interpret behaviour, more or less responsive NPCs, etc..

- Differentiation through role-players: the trainer changes the behavioural instruction of the role-players, changes their appearance by giving them a different VR skin (appearance), changes the speed at which they act or has the role-player carry a knife in one repetition and a machine gun in the next.
- Differentiation through manipulating objects: the trainer changes presence and appearance of weapons (weapons “hidden under a pile of clothes on a desk, behind the back of an NPC, unusual weapons like a hammer etc.), using transparent space or space with many obscured/hidden area.
- The trainer asks the role-player to adapt the course of the scenario on the fly to take advantage of the opportunity to not be visible or audible to trainees as an trainer. Because the trainers’ instructions to the role-player are invisible and inaudible to the trainees even during the scenario, trainers have the freedom to adjust role-player behaviours to their liking (e.g., having the role-player cursing at the trainee). Adjusting role-player behaviour on the fly can be done through wireless headset/microphone communication between trainer and role-player or by physically moving or guiding the role-player to the intended position.
- The trainer creates an increasingly challenging environment for a trainee to have a positive experience and adjust the level of difficulty to the capacities and developmental phase of the trainee.
 - The trainer monitors the trainee’s success by looking at the performance indicators (e.g., DMA-specific behaviours, tactical behaviours, etc.) using the in-action monitoring feedback options that VR offers.
 - If the training seems too simple for the trainee, the trainer up-scales the level of complexity directly by activating additional stress cues or changing the context (e.g., night-time, medium to high level of threat, presence of weapons).
 - If the trainee starts to make mistakes, the trainer may want to down-scale the level of complexity for optimal learning (e.g., daytime, low to medium level of threat).

Didactical Guidelines

Is there possibility for self-regulation of the learning process?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: good practices for self-regulation of learning

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is there Possibility for Self-Regulation of the Learning Process?

Allowing a trainee to manage their learning process makes the trainee an active agent in the process of skill acquisition. In a self-managed learning environment, the trainee can, for example, self-regulate when and how to receive feedback. Self-management of the learning process has been shown to facilitate learning, engagement, transfer, and motivation (Janelle et al., 1995; Lewthwaite et al., 2015; Keetch & Lee, 2007).



tinyurl.com/5dh8p4b2

For relevant information on how to apply the didactical concept of self-regulation of the learning process in VR, **watch this information video by scanning the QR code or clicking the link.**

Good practices for Self-Regulation of Learning per VR Training Phase

Putting on Suits and Calibration

- The trainer asks the trainees to handle and position the gear on the tactical belt themselves, instead of having fixed positions. The trainees can, for example, pick up the tools (weapon, pepperspray, etc.) from a desk and place it on the belt however they like.
- The trainer lets trainees practice with use of the gear on the belt in real-life to ensure that it coincides with their real-life experience. For example, the trainer gives trainees time to familiarise themselves with the VR replica weapons in real life (how to hold it, reload, etc.).
- The trainer allows trainees to choose which training tools they would like to use in addition to the basic equipment. For example, trainees that are carrying an electroshock gun or rifle in daily practice must be able to wear a electroshock gun or rifle in VR training.

Training Instruction

- The trainer ensures that trainees have previous practical knowledge of the relevant skills to apply them in the VR training. The trainer asks the group which knowledge and skills they possess (e.g., what is your current level/ability in your opinion?).
- The trainer asks the group whether they have specific learning objectives they would like to focus on in the VR training (e.g., what would you like to learn or practice today?).
- The trainer asks the trainees if there is anything they would like explained or repeated before starting in the VR environment. For example, specific procedures and movements can be practiced in dry runs with the goggles up.

- The trainer allows the trainee to decide what role they want to play in the scenario. The trainee can, for example, decide to play the perpetrator and give feedback on the performance from the perpetrator perspective in the feedback phase.
- The trainer asks how and on which aspects the trainees would like to receive feedback after the scenario.
- The trainer gives the instruction to trainees that they can stop and pause the scenario at any time. For example, to quickly repeat and re-practice a certain moment in the scenario or to evaluate in between.
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.

Training Execution

- The trainer invites trainees to reflect about their first experience after the initial instruction scenario and asks what their expectations and needs are for the further scenarios.
- The trainer asks trainees whether they would like to repeat an attempt after the scenario.
- The trainer allows trainees to vary difficulty in practice attempts by asking trainees whether they would like to adjust the level of complexity of the scenario.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines visualised in the VR view of the trainees) on or off during the execution of the scenario.

After-Action Review

- The trainer asks the group to reflect on their own decisions based on what is visually observed in the AAR (e.g., the trainees explain why they behaved in the way they did).
- The trainer asks trainees to reflect on their communication on the basis of the sound recorded by the AAR.
- The trainer provides time for questions of trainees.
- The trainer asks trainees to select parts of the scenario they would like to review.
- The trainer lets trainees decide from whom they want feedback. For example, they can choose a colleague that was nearby or who they know to be an expert on the learning objective, or they can choose feedback from trainer.
- The trainer asks trainees to choose an angle or perspective they would like to review their performance from. The trainees can, for example, indicate to review the scenario

from the aggressor's perspective.

- The trainer lets trainees “re-experience” the operation by giving them the AAR controller for a walkthrough in the AAR.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the review of the scenario.

Didactical Guidelines

Is there constructive, motivating feedback?



TARGET GROUP: police training coordinators & trainers

WHAT TO EXPECT: Good practices for constructive and motivating feedback

SOURCES: based on empirical and experiential findings of the research studies and field trials of the SHOTPROS project

AUTHORS: Matthijs Koedijk (VU Amsterdam), Lianne Kleygrewe (VU Amsterdam), Raoul Oudejans (VU Amsterdam), Alexander Schäfer (Police NRW), Ortwin Maetzing (Police NRW), Vana Hutter (VU Amsterdam)

Is there constructive, motivating feedback?

Feedback informs the learner of their performance and supports the learner in evaluating and adjusting the performance behaviour in the future. Providing constructive and motivating feedback has been shown to increase the learner's motivation, self-confidence, self-efficacy and benefits learning (Bandura, 1997; Chiviadowsky, 2020).

For relevant information on how to apply the didactic concept of constructive, motivating feedback in VR, **watch this information video by scanning the QR code or clicking the link.**



tinyurl.com/yykwt3ji

Good practices for constructive and motivating feedback

- The trainer mentions good results and improvements.
- The trainer mentions commitment and efforts of trainees.
- The trainer gives feedback after successful scenario attempts.
- The trainer uses the following feedback structure:
 - Where am I going? What are the learning goals? (e.g., disarming a suspect, doing better than previous repetition).
 - How am I going? What does the evidence tell us about performance? (e.g., we disarmed the suspect to the expected standard, the task was performed more successfully than the previous repetition, and a part of the task that went very well was that we avoided crossfire, a part that went less well is that we moved a little too slowly).
 - Where to next? What learning activities should we do to make better progress? (e.g., we will train to act faster and thus increase the pace of the procedure).
- The trainer gives the trainees time to reflect on their performance and discuss with each other (e.g., trainees discuss how they can improve their movements in tactical procedures).
- The trainer asks each trainee to give their impression of the scenario and describe their own decisions (trainees explain why they behaved in the way they did).
- The trainer formulates feedback in terms of development, something that can be improved. For example, the trainer accompanies feedback with action suggestions or suggestions for learning activities to improve (where to next?).
- The trainer provides time for trainees to ask questions.
- The trainer ensures that the feedback relates to the learning objectives of the training:

- what are the relevant moments? (and why these specifically for the learning objectives of the training);
 - what information is relevant? (and how is this relevant specifically for the learning objectives of the training).
- The trainer substantiates the feedback with careful observation and analysis of the video evidence provided by the VR After-Action Review (AAR):
- The trainer makes the trainees review relevant parts of the scenario by giving them the opportunity to pause and play the AAR. The trainer asks the group to reflect on their own decisions based on what is visually observed in the AAR.
 - The trainer lets trainees review the statistical feedback presented in the AAR such as number of shots fired and targets hit, bystanders flagged, etc.
 - The trainer asks the trainees how they perceived their stress levels throughout the scenario and if they want to see the stress levels reflected in the AAR.
 - The trainer gives the trainees feedback on their communication by using the recorded sound of the AAR.
 - The trainer lets the trainees use the different perspectives from which a scenario can be reviewed in the AAR. For example, the trainer shows the perspective of the suspect to show when contact was made and how trainees entered the room.
- The trainer familiarises him/herself with the buttons and possibilities of the AAR. The trainer ensures that they can recall relevant moments in the scenarios quickly and from the desirable perspectives. As such, trainees are not distracted by scrolling through the timeline during the feedback.
- The trainer asks trainees to lift their VR head mounted display when performing the debrief and providing feedback.
- The trainer involves the role-player to give feedback to trainees. For instance, how the role-player experienced the instructions from the trainees during the scenario (*“what did you hear and understand the trainees say?”*).
- The trainer performs the AAR with a group, while the others train, and rotates the groups accordingly.
- The trainer adds a pain stimulus or other sensoric addition to the VR training to provide instant feedback on performance. This has been shown to enhance the quality of learning and the perceived level of stress.

The following guidelines apply only if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant feedback during the scenario without the trainees being cut out of the VR world (by raising the head mounted display and interact with the “real-life” trainer). The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.
- The trainer wears a VR-suit in instruction mode and takes over a NPC to provide feedback from the point of view of a bystander or the suspect

3 LEAs versions of the didactical guidelines

We asked each LEA to make their own version of each of the seven didactical guidelines for the SHOTPROS project. The LEAs were instructed to write the guidelines in their own words or in a form their trainers could use. The LEAs did not have to include all the guidelines. If some of the advice in the guidelines was not wanted or possible in their context, they could omit it.

This step served two aims: First it fed back how applicable and feasible the didactical guidelines are in practice (see paragraph 4.1 for conclusions), and second it would give each LEA contextualised didactical guidelines that suited the needs and practices of their organization. The individual contributions of the LEAs are listed in the Appendix of this deliverable. You can click on each of the LEAs below to jump straight the contextualised versions of the guidelines.

- [Didactical guidelines - Romanian Ministry of Internal Affairs \(RMIA\)](#)
- [Didactical guidelines - North Rhine-Westphalia Police Force \(LAFP NRW\)](#)
- [Didactical guidelines - National Police of the Netherlands \(NPN\)](#)
- [Didactical guidelines - Swedish Police Authority \(SPA\)](#)
- [Didactical guidelines - Berlin Police \(BP\)](#)

3.1 Insights and conclusions based on LEAs view on the use didactical concepts for their organization

The individual versions of the LEAs show that the established didactical guidelines in SHOTPROS are meaningful and applicable for them, and thus should be very useable in the practice of police (VR) training. This is reflected by the large amount of advice that they adopted literally and directly from the SHOTPROS guidelines. In some cases, LEAs chose to rewrite and add some points that fit well with their organisational vision. Below, we describe aspects that stood out from the LEAs versions, for example, because they were named several times, concrete examples were added, or different approaches were presented:

- In line with the principle of differentiation (see didactical guideline 'variation and differentiation) the LEAs' additions repeatedly emphasize the need to educate and prepare a trainee for VR training and to adapt the training objectives to the trainees' level. LEAs have different ideas to guarantee this, for example by classifying the trainees' level and knowledge after initial training (*e.g., basic, advanced, expert*) or by predefining the sufficient skills and knowledge to successfully achieve the training objectives.
- In various didactical guidelines motivation is mentioned as an intended outcome (for example constructive motivating feedback, clear assignment). In their additions, the LEAs also stress the importance of keeping trainees motivated. They point out that this can

indeed be achieved within different didactical concepts. For example, in the training assignment, the relevance of the learning objective can be continuously stressed and trainers can ask trainees to reflect on this ("this is something I expect in my job"). LEAs also point to good communication with trainees, for example keep checking if trainees feel comfortable and ask them about their needs to create more motivation. Finally, trainees' confidence and motivation can be increased by pointing out good practices, well-demonstrated skills, and positive role models.

- LEAs stress that it is essential not to overload trainees and that a trainee should be able to have success experiences. LEAs cite concrete examples of how they would approach this, for example by asking trainees after successful scenarios whether they are ready for a new learning experience, by always ending the training with a successful performance, and by telling their trainers that to mention positive points at the end of the repetition ("well done") motivates trainees. These suggestions align well with the recommendations in the didactical guidelines of high quality instruction, self-regulation of the learning process, and constructive and motivating feedback, for example.
- LEAs attach great importance to safety in training. They mention several aspects to ensure safety, for instance by setting up clear rules on what is and what is not allowed in VR, deploying a safety coach to oversee deployment rules and aspects that are prohibited, a 'stop' word or code in case the training has to be stopped immediately, conducting a risk analysis including mental issues, and by introducing 'time-outs' when trainees choose the right action that cannot be performed properly/safely in VR Training. These are excellent and important suggestions, for which the LEAs involved in SHOTPROS may want to develop an additional didactical guideline on safe training.

The didactical guidelines provide LEAs with evidence-based and actionable guidance on how to best conduct VR training to attain training effects and motivation in training. Through the input of the LEAs, the didactical guidelines prove to be **meaningful and useable in the practice of police training**

4 Appendix

4.1 Didactical guidelines - Romanian Ministry of Internal Affairs (RMIA)

Good practices for a clear assignment

- The trainer states the learning objective and explains why this learning objective is relevant for the officers.
- ~~○ The trainer discusses with trainees how the learning objective aligns with their training schedule.~~
- The trainer explains what the goal is that the officers need to achieve in the assignment. The trainer should be clear WHAT the officers need to achieve, not necessarily HOW they need to achieve this goal.
- The trainer explains the goal in such a way that the officers would be able to evaluate afterwards if the goal was achieved or not. In other words, officers can answer with a yes or no to the question whether they have completed the assignment. Of course the quality/efficiency/etcetera can be discussed in more detail and feedbacked on by the trainer, but whether the assignment is completed or not should be unequivocal.
- The trainer explains trainees the benefits and limitations of training in VR (e.g., the use of various avatar skins, no need to dress role-player or trainees in a certain way). The trainer takes into account that trainees may initially struggle with the newness of the VR tool itself.
- ~~○ The trainer asks trainees to repeat the assignment in their own words to check for understanding before they start.~~
- The trainer makes use of different VR scenarios, while the training assignment remains the same. The trainer can use risk assessment tool (see D4.7) to create different VR scenarios that align with the assignment. For instance, the assignment is every time: “find the armed suspect”. The trainer can create different scenarios for this assignment:
 - The trainer takes advantage of the flexibility of the virtual environments and uses each repetition a different environment with one armed suspect (an apartment, a furniture shop, an open square, an office space, a school etc.)
 - The trainer varies in complexity of the scenario with the armed suspect (few or many people in the environment, transparent space or space with many obscured/hidden areas, suspect armed with a knife or with a machine gun, many stress factors (children present, dark space, loud noises) or no additional stress factors, etc.
- Trainer asks trainees to repeat/recall what their assignment was before starting the debrief/feedback.

Good practices for high-quality instruction in VR-training

Instructions to prepare for VR training

- The trainer provides a clear overview of security measures in VR training (e.g., physical contact is not possible, a code word to immediately stop a scenario and possibilities of motion sickness).
- The trainer gives trainees a clear overview of what to expect from a VR environment and what tools are available in the VR environment (e.g., NPCs options and how to speak to them, role-player and how to interact with them).
- The trainer provides trainees with step-like instructions on how to put the VR gear on. The gear-specific instructions should be specific and explicit when needed. For example, when putting on the headphones: *“put your hand in this position and press on until you hear a click”*. These measures can be reduced depending on the expertise level of the trainees.
- ~~○ The trainer asks the trainees to help each other with the set-up of the VR gear rather to prepare individually.~~
- In certain situations, where the trainees might have difficulties in putting on the VR suit, the trainer can ask other participants to the training to help in the process, while always maintaining them under his/her supervision
- One of the best approaches is that there should be 1-2 people ready to help for each trainee, as they would make a significant difference in equipping the system correctly and without taking a considerate amount of time.
- The trainer asks the trainees to line up next to each other (with room to move). The trainer then gives the trainees the signal to start a joint calibration process.
- The trainer asks trainees to indicate if there are technical problems with the VR material after the calibration, for example if they have no image or the calibration does not seem to have worked (no realistic movement). If so, the trainer asks the trainee to communicate the problems to the VR operator.
- The trainer explains the purpose of the instructional scenario (tutorial) if included in the training structure.
- The trainer can check if the system fits correctly on every participant, especially in the goggles – visor area, so that they are able to see the images correctly. The trainer can also double check if all the belts are tight enough and if the personal unit carried on the back of each trainee is in an appropriate position.

Instructions during the VR training

- The trainer gives clear commands to trainees when they can put on and take off the visors and headphones to ensure that trainees can follow instructions.
- The trainer provides trainees with training instructions about the structure of the training, learning objectives, and what level of difficulty they can expect.
- The trainer briefs trainees with general dispatch information but does not give away how to handle the situation (*“proceed according to what the situation call for”*).
- The trainer keeps the relevant points that trainees need to pay attention to during the scenario very limited. The trainer gives the trainees concise and single points to focus on, such as *“avoid crossfire”* or *“make sure you scan the entire room by running the walls”* or *“as a group, always keep your six”*.

As a general rule of thumb no more than three points of attention should be given in training, but as the novelty of the VR training tool requires a large amount of the trainee's mental capacity in VR even down tune to one or two.

- The trainer tailors the instruction to the capabilities and developmental stage of the trainees. The trainer builds up the instruction in terms of the number of points on which the trainees must concentrate during the scenario. For example, start with one or two focus points (make sure you scan the whole room by running the walls" and "as a group always keep your six"). If the trainees are successful, the trainer can give the trainees a new focus point ("avoid crossfire"), etc.
- The trainer uses the possibilities of VR to give implicit instruction rather than a specific and step-by-step verbalisation of what to do or what went right and wrong. The trainer can build a self-explanatory scenario, giving clear cues in VR (as is done in gaming) and punishing/rewarding in the VR scenario for doing wrong/good (e.g., having an NPC or role-player come from behind if the group does not keep a 360 degree overview).
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.
- The trainer ensures the role-player's instruction is not overheard by trainees to prevent them from already knowing what is going to happen
- The trainer gives the role-player instruction according to the performance of trainees in previous scenario(s).

This guideline only applies if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant instructions or cues to trainees during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.

Good practices for a well-designed practice situation

- The instructor checks before using VR if there are any arguments against using VR for the learning objective or that other training methods have clear benefit over VR. For instance, if the intention is to include physical contact, handcuffing, training of communication with micro expression, a different training tool would support this practice better. Is the goal to bring together and apply different skills in one scenario and to learn tactical behaviour, or if the trainees would benefit from quick variations in training, then VR might be the ideal solution to go for.
- The instructor selects training environments in VR that trainees may encounter on duty (realistic environment).
- The instructor selects scenarios in VR that present tasks and challenges that trainees may encounter on duty (realistic problem).
- The instructor ensures that in VR trainees can execute their tasks and find solutions to the challenge that are similar to tasks and solutions required on duty (realistic solutions).

- The instructor ensures that trainees have access to the same tools as in real-life, for instance, if a trainee carries a taser in real-life, the trainee should be able to carry taser in the VR belt as well.
- The instructor ensures that the number of trainees in a team is representative for the task and realistic for real-life performance (e.g., by how many trainees are the tasks and procedures expected in the VR scenarios normally performed in real-life)?
- The instructor ensures that the solutions provoked are as realistic as possible and achievable in VR. For instance, having a role-player acting as a suspect and giving the instruction to use physical force or resistance would not be useful as this requires a solution that cannot be performed by the officer in VR such as self-defence and physical arresting skills.
- The instructor selects scenarios according to the experience and level of expertise of trainees, properly scaffolding learning experiences to fit the level of the trainees. Clearly, special forces will work with more complex scenarios than police academy recruits, and the aim should be to practice near/around the zones of proximal development of the trainees.
- The level of learning would be adapted to the training needs and the level of the target group (e.g. basic, intermediate, advanced) and the scenarios would follow an incremental development .
- ~~○ The instructor checks whether certain pitfalls of VR can be avoided in the training; for example, are stairs a necessary part of the training? And is it necessary that doors are closed in a VR scenario or can they already be open? (Since executions of the stair movement and opening doors are not yet experienced as realistic and natural by the trainees).~~
- The instructor would avoid using the pitfalls of VR such as stairs and doors to be opened, but he can chose to keep them if he decide to enhance the difficulty of the scenarios
- By controlling or directing the responses of role-players and NPCs on the fly and in correspondence with the behaviour of the trainee, the instructor can foster trainees' beliefs in their capabilities to perform an action successfully. For instance, when the trainee performs well, make sure the role-player or NPC rewards the behaviour of the trainee thus providing the experience of success to the trainee. If trainees consistently fail, and the instructor fears that motivation and confidence will be lost in trainees, they may choose to simplify the scenario or adapt behaviour of the role player/NPC to pick trainees motivation back up again.
- The instructor avoids familiarizing the trainees with the training environment, since in reality officers constantly encounter new and unfamiliar situations and it is important for the transfer of skills that the skills are constantly applied in new contexts. Therefore, the instructor adapts the scenario and the environment from repetition to repetition (e.g. from an outdoor scenario in the car park in daylight to an outdoor scenario on a busy road at night; placing and removing walls and doors can be done quickly by the VR operator).
- The instructor ensures that no repetition of a scenario is exactly the same as the previous since in reality no situation is the same as another. Therefore the instructor adjusts role-player instructions

from repetition to repetition (e.g., instructing the role-player to act with weapon in one scenario and without a weapon in the next repetition).

- The way of acting of a role-player can vary in the sense of increasing aggressiveness from scenario to scenario. From scenario to scenario the role-player can be given more lethal weapons, starting with nothing in hands, for example, and going all the way up to knives, handguns or assault weapons etc.
- The instructor makes a quick analysis of what is needed in the next repetition or practice situation depending on the trainees' performance. The instructor then adapts the scenario (the environment, the behaviour of the role-players or NPCs, the assignment for the trainees, etc) to meet the needs. For example, if the performance of the team shows the instructor that the trainees do not maintain a 360 overview of the situation while processing, the next environment, the behaviour of the role-players or the assignment should force the trainees to better maintain their 360 overview. For example, by placing trainees in an area where threats can come from all directions, by placing NPCs in places that they would typically miss if they were sloppy with the 360 view, etc.
- The instructor ensures that the practice situation forces or invites the trainees to act in a certain way, without the need for explicit instruction. For example, a scenario where a perpetrator harms an individual until the perpetrator is stopped forces the trainees to speed up. Or if the environment is very cluttered (lots of people, stuff or spaces) it forces the trainees to scan the environment in a very focused and structured way.
- The instructor can opt to scale up the difficulty of the training sessions by including an increased number of stimuli to consolidate the preparedness of the trainees for real-life situations (“train hard to fight easy”)

Good practices for model learning

- ~~○ The trainer makes use of trainees as peer observational models (instead of solely relying on expert models).~~
- The trainer relies on an expert model to serve as a point of observation and learning for the trainees, whereas using one of the trainee as a peer observational model would require extra time for pre-training and his/her knowledge gained might be superficial
 - The trainer can divide the trainees' group, during a training with four, two trainees are executing the training scenario in VR while the other two trainees can observe the performance on an external screen (AAR) using various viewing perspectives and a variety of abstract performance indicators (e.g., line of fire, movement paths, field of view, performance statics).
 - ~~○ For instance, the trainer asks the trainees to designate a commander within the group who will lead the scenario execution and after action review. By having different commanders within the group during the course of the training, trainees can learn from each other's approaches and operating methods.~~
 - In certain activities, the trainer can ask one of the trainees to serves as a peer model (e.g. on how to take off the gear in a procedural fashion (step-by-step)).

- The trainer gives trainees a clear and specific viewing task related to the training or learning objective. For example, trainees may watch the execution of a scenario in three different situations (e.g. observing on the AAR screen while others are training, observing as "ghosts" in the VR environment while others are training or during a joint after action review). In all three situations, the trainer should give the trainees a clear and specific viewing task (e.g. instruct them to watch for decisive DMA moments; or evaluate a particular tactical skill; or observing a particular member of the group). This increases focus, steers the direction of the model's learning and ensures that the trainees observe the model's behaviour.
- The trainer uses the VR "Ghost Mode". Trainer or trainee can actively be part of the virtual environment as a "ghost" and observe the other trainees' performance in the scenario without being visible to them.
- The trainer uses the AAR as video feedback to allow the trainee to learn from their own implementation as a model.

This guideline applies only if the trainer is wearing a VR suit:

- The trainer serves as an expert model for demonstration of certain skills or behaviours in the VR environment. The trainer can demonstrate sub-skills or sub-movements acting visible in the virtual environment.
- The trainer can either take the role of the perpetrator or serving as a member of the intervention team, taking action together with the rest of the trainees, providing tips and insights alongside the duration of the whole training session, or by explaining in real time with the personal example, certain procedures or intervention techniques.

Good practices for variation and differentiation

- The trainer ensures that they have a predetermined selection database of VR environments (e.g. a minimum of three different virtual environments to vary easily and quickly in practice situations).
- To achieve variation and create a new practice situation, the trainer changes the context of the virtual environment for each repetition:
 - Through environmental changes: location variation (an apartment, a furniture shop, an open square, an office space, a school etc.) and additional objects in the environment, etc.
 - Through different starting points for trainees and role-players in the same virtual environment. For instance, the trainees start in the same building in one repetition at the main entrance and in the next repetition they start at the back entrance and the position of the role-player is in the first repetition in the kitchen and in the next repetition in the living room.
 - The trainer can remove one or more trainees from the team, to simulate the training with one or more missing members.

- To achieve differentiation, the trainer varies the level of complexity per repetition:
 - Differentiation through NPC: the trainer changes NPC level of aggression or changes their appearance, few or many NPCs in the environment, NPCs with harder to interpret behaviour, more or less responsive NPCs, etcetera.
 - Differentiation through role-players: the trainer changes the behavioural instruction of the role-players, changes their appearance by giving them a different VR skin, changes the speed at which they act or has the role-player carry a knife in one repetition and a machine gun in the next.
 - Differentiation through manipulating objects: the trainer changes presence and appearance of weapons (weapons “hidden under a pile of clothes on a desk, behind the back of an NPC, unusual weapons like a hammer etc.), using transparent space or space with many obscured/hidden area.
- The trainer asks the role-player to adapt the course of the scenario on the fly to take advantage of the opportunity to not be visible or audible to trainees as a trainer. Because the trainers’ instructions to the role-player are invisible and inaudible to the trainees even during the scenario, trainers have the freedom to adjust role-player behaviours to their liking (e.g., having the role-player cursing at the trainee). Adjusting role-player behaviour on the fly can be done through wireless headset/microphone communication between trainer and role-player or by physically moving or guiding the role-player to the intended position.
- The trainer can help the role-player reposition during the field trial, or relocate to a different location. The role player can lift his goggles and move to a different position, while being invulnerable and invisible to the trainees, in order for him to simulate an escape through the window or a similar action.
- The trainer creates an increasingly challenging environment for a trainee to have a positive experience and adjust the level of difficulty to the capacities and developmental phase of the trainee.
 - The trainer monitors the trainee’s success by looking at the performance indicators (e.g., DMA-specific behaviours, tactical behaviours, etc.) using the in-Action Feedback that VR offers.
 - If the training seems too simple for the trainee, the trainer up-scales the level of complexity directly by activating additional stress cues or changing the context (e.g., night-time, medium to high level of threat, presence of weapons).
 - If the trainee starts to make mistakes, the trainer may want to down-scale the level of complexity for optimal learning (e.g., daytime, low to medium level of threat).

Good practices for Self-Regulation of Learning per VR Training Phase

Putting on Suits and Calibration

- The trainer asks the trainees to handle and position the gear on the gear belt themselves, instead of having fixed positions. The trainees can, for example, pick up the tools (weapon, pepperspray, etc.) from a desk and place it on the belt however they like.

- The trainer lets trainees practice with use of the gear on the belt in real-life to ensure that it coincides with their real-life experience. For example, the trainer gives trainees time to familiarize themselves with the VR replica weapons in real life (how to hold it, reload, etc.).
- The trainer allows trainees to choose which training tools they would like to use in addition to the basic equipment. For example, trainees that are carrying a taser or rifle in daily practice must be able to wear a taser or rifle in VR training.
- The trainer can also try to teach the trainees how to handle different weapons / equipment, even if they are not familiar with it, or do not use it in their day to day activity. This is done in the idea of learning something new, not necessarily improving the real life training and should not be something focused on that much. Nonetheless the trainer can give instructions on how to use certain gear in order to familiarize the trainees with their use in the virtual scenarios.

Training Instruction

- The trainer ensures that trainees have previous practical knowledge of the relevant skills to apply them in the VR training. The trainer asks the group which knowledge and skills they possess (e.g., what is your current level/ability in your opinion?).
- The trainer asks the group whether they have specific learning objectives they would like to focus on in the VR training (e.g., what would you like to learn or practice today?).
- The trainer asks the trainees if there is anything they would like explained or repeated before starting in the VR environment. For example, specific procedures and movements can be practiced in dry runs with the goggles up.
- ~~○ The trainer allows the trainee to decide what role they want to play in the scenario. The trainee can, for example, decide to play the perpetrator and give feedback on the performance from the perpetrator perspective in the feedback phase.~~
- The trainer would decide what roles to allocate to the trainees, so as to help them improve knowledge or skills they might be deficient at. In case the role of perpetrator is played by one the trainees, he can provide feedback from angle of view during AAR
- ~~○ The trainer asks how and on which aspects the trainees would like to receive feedback after the scenario.~~
- ~~○ The trainer gives the instruction to trainees that they can stop and pause the scenario at any time. For example, to quickly repeat and re-practice a certain moment in the scenario or to evaluate in between.~~
- The trainer would allow the trainees to repeat some of the parts of the scenarios which were not properly executed or performed after the first complete run
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.

Training Execution

- The trainer invites trainees to reflect about their first experience after the initial instruction scenario, and asks what their expectations and needs are for the further scenarios.
- The trainer asks trainees whether they would like to repeat an attempt after the scenario.
- The trainer allows trainees to vary difficulty in practice attempts by asking trainees whether they would like to adjust the level of complexity of the scenario.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the execution of the scenario.

After Action Review

- The trainer asks the group to reflect on their own decisions based on what is visually observed on the AAR (e.g., the trainees explain why they behaved in the way they did).
- The trainer asks trainees to reflect on their communication on the basis of the sound recorded by the AAR.
- The trainer provides time for questions of trainees.
- ~~The trainer lets trainees decide from whom they want feedback. For example, they can choose a colleague that was nearby or who they know to be an expert on the learning objective, or they can choose feedback from trainer.~~
- The trainer provides feedback to the trainees in the AAR or, in case he is seconded by an expert on the subject, he can let that person to contribute as well. Any contribution from the trainees is also appreciated
- The trainer asks trainees to select parts of the scenario they would like to review.
- The trainer asks trainees to choose an angle or perspective they would like to review their performance from. The trainees can, for example, indicate to review the scenario from the aggressor's perspective.
- The trainer lets trainees “re-experience” the operation by giving them the AAR controller for a walkthrough in the AAR.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the review of the scenario.

Good practices for constructive and motivating feedback

- The trainer names good results and improvements.

- The trainer names commitment and efforts of trainees.
- The trainer gives feedback after successful scenario attempts.
- The trainer uses the following feedback structure:
 - Where am I going? What are the learning goals? (e.g., disarming a suspect, doing better than previous repetition).
 - How am I going? What does the evidence tell us about performance? (e.g., we disarmed the suspect to the expected standard, the task was performed more successfully than the previous repetition, and a part of the task that went very well was that we avoided crossfire, a part that went less well is that we moved a little too slowly).
 - Where to next? What learning activities should we do to make better progress? (e.g., we will train to act faster and thus increase the pace of the procedure).
- The trainer gives the trainees time to reflect on their performance and discuss with each other (e.g., trainees discuss how they can improve their movements in tactical procedures).
- The trainer asks each trainee to give their impression of the scenario and describe their own decisions (trainees explain why they behaved in the way they did).
- The trainer formulates feedback in terms of development, something that can be improved. For example, the trainer accompanies feedback with action suggestions or suggestions for learning activities to improve (where to next?).
- The trainer provides time for trainees to ask questions.
- The trainer can ask the trainees if they understood their tasks and can check if they owned correctly all the given information by asking certain question to each of the trainee, in order to verify their degree of attention and retention of information.
- At the beginning of the session as well as during the training session the trainer can check up on the trainees and ask for feedback in order to see if any issues occurred, whether they are related to the good functioning of the equipment, physical, emotional or psychological nature.
- The trainer ensures that the feedback relates to learning objectives of the training:
 - what are the relevant moments? (and why these specifically for the learning objectives of the training);
 - what information is relevant?; (and how is this relevant specifically for the learning objectives of the training)
- The trainer substantiates the feedback with careful observation and analysis of the video evidence provided by the VR After-Action Review (AAR):
 - The trainer makes the trainees review relevant parts of the scenario by giving them the opportunity to pause and play the AAR. The trainer asks the group to reflect on their own decisions based on what is visually observed on the AAR.
 - The trainer lets trainees review the statistical feedback presented in the AAR such as number of shots fired and targets hit, bystanders flagged, etc.
 - The trainer asks the trainees how they perceived their stress levels throughout the scenario and if they want to see the stress levels reflected in the AAR.
 - The trainer gives the trainees feedback on their communication by using the recorded sound of the AAR.

- The trainer lets the trainees use the different perspectives from which a scenario can be reviewed in the AAR. For example, the trainer shows the perspective of the suspect to show when contact was made and how trainees entered the room.
- The trainer familiarises himself with the buttons and possibilities of the AAR. The trainer ensures that they can recall relevant moments in the scenarios quickly and from the desirable perspectives. As such, trainees are not distracted by scrolling through the timeline during the feedback. *The trainer can mark specific moments in the scenario which are of interest to the training process and can be rapidly reviewed later in the AAR*
- The trainer asks trainees to lift their VR head mounted display when performing the debrief and providing feedback.
- The trainer involves the role-player to give feedback to trainees. For instance, how the role-player experienced the instructions from the trainees during the scenario (*“what did you hear and understand the trainees say?”*).
- The trainer performs the AAR with part of the group, while the other half trains *under the supervision of another trainer, and then rotates the groups accordingly.*
- The trainer adds a pain stimulus to the VR training to provide instant feedback on performance. This has been shown to enhance the quality of learning and the perceived level of stress.

These guidelines apply only if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant feedback during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.
- The trainer wears a VR-suit in instruction mode and takes over an NPC to provide feedback from the point of view of a bystander or the suspect.

4.2 Didactical guidelines - North Rhine-Westphalia Police Force (LAFP NRW)

Good practices for a clear assignment

- The trainer states the learning objective and explains why this learning objective is relevant for the officers.
Choose a clear assignment to make the pre-training or actual training experience relevant for your trainees. If possible, let your trainees reflect on the question of learning objectives and relevance for themselves and the organisation.
- The trainer discusses with trainees how the learning objective aligns with their training schedule.
Reassure your students that they have been trained and prepared for this exact scenario/challenge and are ready for it.

- The trainer explains what the goal is that the officers need to achieve in the assignment. The trainer should be clear WHAT the officers need to achieve, not necessarily HOW they need to achieve this goal.
 Explain the scenario/assignment goals using professional language or tactical radio communication terminology. If possible, do not explain how the trainees can achieve these.
- Ask your trainees to repeat/recall what their assignment was before starting the debrief/feedback.
- The trainer makes use of different VR scenarios, while the training assignment remains the same. The trainer can use risk assessment tool (see D4.7) to create different VR scenarios that align with the assignment. For instance, the assignment is every time: “find the armed suspect”. The trainer can create different scenarios for this assignment:
 - The trainer takes advantage of the flexibility of the virtual environments and uses each repetition a different environment with one armed suspect (an apartment, a furniture shop, an open square, an office space, a school etc.)
 - The trainer varies in complexity of the scenario with the armed suspect (few or many people in the environment, transparent space or space with many obscured/hidden areas, suspect armed with a knife or with a machine gun, many stress factors (children present, dark space, loud noises) or no additional stress factors, etc.

Make use the flexibility of the VR-Environment to run one successful scenario several times, with the same assignment but with differing difficulty levels or scenario outcomes. Play “what if” by including objective stressors and by adjusting role-player behaviour. Do not overpower your trainees but challenge them for new successes.

Use this approach, especially for high-performing groups.

If trainees have achieved a certain level of prowess, use different VR environments on the same assignment. For example a traffic stop with an armed suspect (assignment is “vehicle with armed suspect”) on a lonely road. Second the same traffic stop on a city road at night and with low traffic. Third the same traffic stop on a city road with many pedestrians and traffic around.

Use this approach especially for high-performing groups.

Good practices for high-quality instruction in VR-training

Instructions to prepare for VR training

- The trainer provides a clear overview of security measures in VR training (e.g., physical contact is not possible, a code word to immediately stop a scenario and possibilities of motion sickness).
 Implement a “safety coach” and provide clear rules of engagement on what is possible and what is forbidden in VR-Training. Set up an emergency procedure including an “Abort Training”-wording in case of emergencies.
- The trainer gives trainees a clear overview of what to expect from a VR environment and what tools are available in the VR environment (e.g., NPCs options and how to speak to them, role-player and how to interact with them)

- The trainer provides trainees with step-like instructions on how to put the VR gear on. The gear-specific instructions should be specific and explicit when needed. For example, when putting on the headphones: *“put your hand in this position and press on until you hear a click”*. These measures can be reduced depending on the expertise level of the trainees.
- The trainer asks the trainees to help each other with the set-up of the VR gear rather than prepare individually.
- The trainer asks the trainees to line up next to each other (with room to move). The trainer then gives the trainees the signal to start a joint calibration process.
- The trainer asks trainees to indicate if there are technical problems with the VR material after the calibration, for example if they have no image or the calibration does not seem to have worked (no realistic movement). If so, the trainer asks the trainee to communicate the problems to the VR operator.
- The trainer explains the purpose of the instructional scenario (tutorial) if included in the training structure.

Instructions during the VR training

- The trainer gives clear commands to trainees when they can put on and take off the visors and headphones to ensure that trainees can follow instructions.
- The trainer provides trainees with training instructions about the structure of the training, learning objectives, and what level of difficulty they can expect.
- The trainer briefs trainees with general dispatch information but does not give away how to handle the situation (*“proceed according to what the situation call for”*).
- The trainer keeps the relevant points that trainees need to pay attention to during the scenario very limited. The trainer gives the trainees concise and single points to focus on, such as *“avoid crossfire”* or *“make sure you scan the entire room by running the walls”* or *“as a group, always keep your six”*. As a general rule of thumb no more than three points of attention should be given in training, but as the novelty of the VR training tool requires a large amount of the trainee’s mental capacity in VR even down tune to one or two.
- The trainer tailors the instruction to the capabilities and developmental stage of the trainees. The trainer builds up the instruction in terms of the number of points on which the trainees must concentrate during the scenario. For example, start with one or two focus points (make sure you scan the whole room by running the walls" and "as a group always keep your six"). If the trainees are successful, the trainer can give the trainees a new focus point ("avoid crossfire"), etc.
- The trainer uses the possibilities of VR to give implicit instruction rather than a specific and step-by-step verbalisation of what to do or what went right and wrong. The trainer can build a self-explanatory

scenario, giving clear cues in VR (as is done in gaming) and punishing/rewarding in the VR scenario for doing wrong/good (e.g., having an NPC or role-player come from behind if the group does not keep a 360 degree overview).

- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification
- The trainer ensures the role-player's instruction is not overheard by trainees to prevent them from already knowing what is going to happen
- The trainer gives the role-player instruction according to the performance of trainees in previous scenario(s).

This guideline only applies if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant instructions or cues to trainees during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.

Good practices for a well-designed practice situation

- The trainer checks before using VR if there are any arguments against using VR for the learning objective or that other training methods have clear benefit over VR. For instance, if the intention is to include physical contact, handcuffing, training of communication with micro expression, a different training tool would support this practice better. Is the goal to bring together and apply different skills in one scenario and to learn tactical behaviour, or if the trainees would benefit from quick variations in training, then VR might be the ideal solution to go for.
- The trainer selects training environments in VR that trainees may encounter on duty (realistic environment).
- The trainer selects scenarios in VR that present tasks and challenges that trainees may encounter on duty (realistic problem).
- The trainer ensures that in VR trainees can execute their tasks and find solutions to the challenge that are similar to tasks and solutions required on duty (realistic solutions).
- The trainer ensures that trainees have access to the same tools as in real-life, for instance, if a trainee carries a taser in real-life, the trainee should be able to carry taser in the VR belt as well.
- The trainer ensures that the number of trainees in a team is representative for the task and realistic for real-life performance (e.g., by how many trainees are the tasks and procedures expected in the VR scenarios normally performed in real-life)?
- The trainer ensures that the solutions provoked are as realistic as possible and achievable in VR. For instance, having a role-player acting as a suspect and giving the instruction to use physical force or resistance would not be useful as this requires a solution that cannot be performed by the officer in VR such as self-defence and physical arresting skills.

Scenario solutions must be in compliance with laws and use of force policies of your organisation. Plan for proper “exit points” in specific use of force situations by using “coaching in process-techniques” or “time-outs” when trainees decided for the correct action that cannot be executed properly/safely in VR-Training.

Plan for a respective real world training in addition to the VR-Experience.

- The trainer selects scenarios according to the experience and level of expertise of trainees, properly scaffolding learning experiences to fit the level of the trainees. Clearly, special forces will work with more complex scenarios than police academy recruits, and the aim should be to practice near/around the zones of proximal development of the trainees.
- By controlling or directing the responses of role-players and NPCs on the fly and in correspondence with the behaviour of the trainee, the trainer can foster trainees’ beliefs in their capabilities to perform an action successfully. For instance, when the trainee performs well, make sure the role-player or NPC rewards the behaviour of the trainee thus providing the experience of success to the trainee. If trainees consistently fail, and the trainer fears that motivation and confidence will be lost in trainees, they may choose to simplify the scenario or adapt behaviour of the role player/NPC to pick trainees motivation back up again.
- The trainer avoids familiarizing the trainees with the training environment, since in reality officers constantly encounter new and unfamiliar situations and it is important for the transfer of skills that the skills are constantly applied in new contexts. Therefore, the trainer adapts the scenario and the environment from repetition to repetition (e.g. from an outdoor scenario in the car park in daylight to an outdoor scenario on a busy road at night; placing and removing walls and doors can be done quickly by the VR operator).
- The trainer ensures that no repetition of a scenario is exactly the same as the previous since in reality no situation is the same as another. Therefore the trainer adjusts role-player instructions from repetition to repetition (e.g., instructing the role-player to act with weapon in one scenario and without a weapon in the next repetition).

And the intensity of the role player's actions is determined by the situation.

If your trainees concluded a scenario successfully, repeat the scenario with differing role-player behaviour. From non-cooperative to cooperative, from submissive to aggressive etc. in alignment with the training goals and assignment. This will properly train them on the process of decision making and acting in compliance with their daily duty and in compliance with the use of force policies of their organisation.

Do not try to win but challenge them on their individual skill level and in accordance with their work profile.

In addition this will prevent training them only in one directional use-of-force or only de-escalating behaviours.

- The trainer makes a quick analysis of what is needed in the next repetition or practice situation depending on the trainees' performance. The trainer then adapts the scenario (the environment, the behaviour of the role-players or NPCs, the assignment for the trainees, etc) to meet the needs. For example, if the performance of the team shows the trainer that the trainees do not maintain a 360 overview of the situation while processing, the next environment, the behaviour of the role-players or the assignment should force the trainees to better maintain their 360 overview. For example, by

placing trainees in an area where threats can come from all directions, by placing NPCs in places that they would typically miss if they were sloppy with the 360 view, etc.

The aim is to bring the participants to new learning experiences through the adjustments.

I would not advise to encourage trainers to do that because it might lead to a trainer vs trainees smart ass atmosphere of the bad old times. 😊

I would advise to make the analysis (feedback, after action review) and ask the trainees if they would like to experience the effect of the problem. This gives them the chance to “save face” and have a successful training repetition.

- The trainer ensures that the practice situation forces or invites the trainees to act in a certain way, without the need for explicit instruction. For example, a scenario where a perpetrator harms an individual until the perpetrator is stopped forces the trainees to speed up. Or if the environment is very cluttered (lots of people, stuff or spaces) it forces the trainees to scan the environment in a very focused and structured way.

This corresponds to the real situation conditions that can be found in operational situations.

Design your practice situation in a way that it allows fluid and realistic decision making and acting processes in combination with the application of present skills for your trainees.

Good practices for model learning

- The trainer makes use of trainees as peer observational models (instead of solely relying on expert models).

If possible, use your trainees as positive role models for the training group. Point out good practices or skills demonstrated in order to raise trust and motivation with your training group.

- For instance, during a training with four, two trainees are executing the training scenario in VR while the other two trainees can observe the performance on an external screen (AAR) using various viewing perspectives and a variety of abstract performance indicators (e.g., line of fire, movement paths, field of view, performance statics).

Let training sessions be monitored by inactive parts of the group.

- For instance, the trainer asks the trainees to designate a commander within the group who will lead the scenario execution and after-action review. By having different commanders within the group during the course of the training, trainees can learn from each other's approaches and operating methods.

If possible, designate a “Teamleader” who is also in charge of parts of the AAR-Feedback. Rotate the Teamleader function as often as possible if the trainees are successful in their performance.

- For instance, one of the trainees serves as a peer model on how to take off the gear in a procedural fashion (step-by-step).
- The trainer gives trainees a clear and specific viewing task related to the training or learning objective. For example, trainees may watch the execution of a scenario in three different situations (e.g. observing on the AAR screen while others are training, observing as "ghosts" in the VR environment while others are training or during a joint after action review). In all three situations, the trainer should give the trainees a clear and specific viewing task (e.g. instruct them to watch for decisive DMA

moments; or evaluate a particular tactical skill; or observing a particular member of the group). This increases focus, steers the direction of the model's learning and ensures that the trainees observe the model's behaviour.

Provide inactive trainees with sophisticated monitoring assignments for the AAR and feedback.

- The trainer uses the AAR as video feedback to allow the trainee to learn from their own implementation as a model.

This guideline applies only if the trainer is wearing a VR suit:

- The trainer serves as an expert model for demonstration of certain skills or behaviours in the VR environment. The trainer can demonstrate sub-skills or sub-movements acting visible in the virtual environment.

Good practices for variation and differentiation

- The trainer ensures that they have a predetermined selection database of VR environments (e.g. a minimum of three different virtual environments to vary easily and quickly in practice situations).
- To achieve variation and create a new practice situation, the trainer changes the context of the virtual environment for each repetition:
 - Through environmental changes: location variation (an apartment, a furniture shop, an open square, an office space, a school etc.) and additional objects in the environment, etc.
 - Through different starting points for trainees and role-players in the same virtual environment. For instance, the trainees start in the same building in one repetition at the main entrance and in the next repetition they start at the back entrance and the position of the role-player is in the first repetition in the kitchen and in the next repetition in the living room.
Also through additional stress stimuli selected and adapted to the situation.
- To achieve differentiation, the trainer varies the level of complexity per repetition:
 - Differentiation through NPC: the trainer changes NPC level of aggression or changes their appearance, few or many NPCs in the environment, NPCs with harder to interpret behaviour, more or less responsive NPCs, etcetera.
 - Differentiation through role-players: the trainer changes the behavioural instruction of the role-players, changes their appearance by giving them a different VR skin, changes the speed at which they act or has the role-player carry a knife in one repetition and a machine gun in the next.
 - Differentiation through manipulating objects: the trainer changes presence and appearance of weapons (weapons "hidden under a pile of clothes on a desk, behind the back of an NPC, unusual weapons like a hammer etc.), using transparent space or space with many obscured/hidden area.

- The trainer asks the role-player to adapt the course of the scenario on the fly to take advantage of the opportunity to not be visible or audible to trainees as a trainer. Because the trainers' instructions to the role-player are invisible and inaudible to the trainees even during the scenario, trainers have the freedom to adjust role-player behaviours to their liking (e.g., having the role-player cursing at the trainee). Adjusting role-player behaviour on the fly can be done through wireless headset/microphone communication between trainer and role-player or by physically moving or guiding the role-player to the intended position.
 This option should be chosen very carefully and in order to ensure a success for the trainees.
- The trainer creates an increasingly challenging environment for a trainee to have a positive experience and adjust the level of difficulty to the capacities and developmental phase of the trainee.
 - The trainer monitors the trainee's success by looking at the performance indicators (e.g., DMA-specific behaviours, tactical behaviours, etc.) using the in-Action Feedback that VR offers.
 - If the training seems too simple for the trainee, the trainer up-scales the level of complexity directly by activating additional stress cues or changing the context (e.g., night-time, medium to high level of threat, presence of weapons).
 - If the trainee starts to make mistakes, the trainer may want to down-scale the level of complexity for optimal learning (e.g., daytime, low to medium level of threat).

Good practices for self-regulation of learning

- The trainer asks the trainees to handle and position the gear on the tactical belt themselves, instead of having fixed positions. The trainees can, for example, pick up the tools (weapon, pepperspray, etc.) from a desk and place it on the belt however they like.
- The trainer lets trainees practice with use of the gear on the belt in real-life to ensure that it coincides with their real-life experience. For example, the trainer gives trainees time to familiarise themselves with the VR replica weapons in real life (how to hold it, reload, etc.).
- The trainer allows trainees to choose which training tools they would like to use in addition to the basic equipment. For example, trainees that are carrying an electroshock gun or rifle in daily practice must be able to wear a electroshock gun or rifle in VR training.
- Give your trainees some time and space to familiarize themselves with „new gear or use of force tools“ (positioning, handling etc.)
- Finally ask your participants whether they are feeling comfortable and „ready to go on the mission“!

Training instruction

- The trainer ensures that trainees have previous practical knowledge of the relevant skills to apply

them in the VR training. The trainer asks the group which knowledge and skills they possess (e.g., what is your current level/ability in your opinion?).

- The trainer asks the group whether they have specific learning objectives they would like to focus on in the VR training (e.g., what would you like to learn or practice today?).
- Make sure that you have distinctive and predefined training goals and that your scenarios were segmented and designed especially to reach those!
- Be sure that your pre-analysis of the trainee group matches the training goals and the scenario. Make sure by conducting a proper pre-analysis that only trainees enter your scenario who possess a sufficient skillset and knowledge to successfully meet the training goals.
- Make sure that you control that learning process by properly deciding on the use of role-players or AI. See to it that both are properly scripted.
- The trainer asks the trainees if there is anything they would like explained or repeated before starting in the VR environment. For example, specific procedures and movements can be practiced in dry runs with the goggles up.
- The trainer allows the trainee to decide what role they want to play in the scenario. The trainee can, for example, decide to play the perpetrator and give feedback on the performance from the perpetrator perspective in the feedback phase.
- The trainer asks how and on which aspects the trainees would like to receive feedback after the scenario.
- The trainer gives the instruction to trainees that they can stop and pause the scenario at any time. For example, to quickly repeat and re-practice a certain moment in the scenario or to evaluate in between.
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.
- If they make good training progress give your participants the opportunity to shift feedback focus to their specific needs. Give them options for feedback according to their needs to gain more acceptance and motivation.
- Point out to the trainees that in case of failure or underperformance the method of coaching in process and direct repetition cycles will be used.
- Encourage your trainees at any time to question scenario information and simulated despatch radio calls for further vital information in order to have a „clear picture“ on the task at hand and receiving all vital scenario information available.

Training Execution

- The trainer **invites trainees to reflect** about their **first experience** after the initial instruction scenario and asks what their expectations and needs are for the further scenarios.
- The trainer asks **trainees whether** they would **like to repeat** an attempt after the scenario.
- The trainer allows trainees to **vary difficulty in practice attempts** by asking trainees whether they would like to adjust the level of complexity of the scenario.
- The trainer lets trainees **choose to have help tools** (e.g., line of fire, movement lines visualised in the VR view of the trainees) on or off during the execution of the scenario.
- Get feedback from your participants if they feel comfortable with the tutorial or if they need anything more to get „scenario ready“!
- Urge your trainees to repeat a „failed“ scenario and encourage them to train at a „difficulty level“ that poses a challenge to them.

After Action Review

First get your trainees to **orate (steam off)** their reflections and emotions about what they experienced in the scenario.

- The trainer asks the group to reflect on their own decisions based on what is visually observed in the AAR (e.g., the trainees explain why they behaved in the way they did).
- The trainer asks trainees to reflect on their communication on the basis of the sound recorded by the AAR.
- The trainer provides time for questions of trainees.
- The trainer asks trainees to select parts of the scenario they would like to review.
- The trainer lets trainees decide from whom they want feedback. For example, they can choose a colleague that was nearby or who they know to be an expert on the learning objective, or they can choose feedback from trainer.
- The trainer asks trainees to choose an angle or perspective they would like to review their performance from. The trainees can, for example, indicate to review the scenario from the aggressor's perspective.
- In case of failure urge them to a repetition cycle and make them verbalize their intent for the repetition.
- In case of success make them verbalize their intent for the upcoming scenarios.
- The trainer lets trainees “re-experience” the operation by giving them the AAR controller for a walkthrough in the AAR.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the review of the scenario.

Good practices for constructive and motivating feedback

- The trainer names good results and improvements.
- The trainer names commitment and efforts of trainees.
- The trainer gives feedback after successful scenario attempts.
These steps are standard in our training structure
- The trainer uses the following feedback structure:
 - Where am I going? What are the learning goals? (e.g., disarming a suspect, doing better than previous repetition).
 - How am I going? What does the evidence tell us about performance? (e.g., we disarmed the suspect to the expected standard, the task was performed more successfully than the previous repetition, and a part of the task that went very well was that we avoided crossfire, a part that went less well is that we moved a little too slowly).
 - Where to next? What learning activities should we do to make better progress? (e.g., we will train to act faster and thus increase the pace of the procedure).

We would like to implement this structure in our organization!

- The trainer asks each trainee to give their impression of the scenario and describe their own decisions (trainees explain why they behaved in the way they did).

Ask your trainees after the training to give a short individual statement about their performance and decisions. Do this as an “opener” prior to the above mentioned feedback.

- The trainer formulates feedback in terms of development, something that can be improved. For example, the trainer accompanies feedback with action suggestions or suggestions for learning activities to improve (where to next?).

- The trainer provides time for trainees to ask questions.

Ask your trainees if they have any further questions.

- The trainer ensures that the feedback relates to learning objectives of the training:
 - what are the relevant moments? (and why these specifically for the learning objectives of the training);
 - what information is relevant?; (and how is this relevant specifically for the learning objectives of the training)
- The trainer substantiates the feedback with careful observation and analysis of the video evidence provided by the VR After-Action Review (AAR):

- The trainer makes the trainees review relevant parts of the scenario by giving them the opportunity to pause and play the AAR. The trainer asks the group to reflect on their own decisions based on what is visually observed on the AAR.
 - The trainer asks the trainees how they perceived their stress levels throughout the scenario and if they want to see the stress levels reflected in the AAR.
 - The trainer gives the trainees feedback on their communication by using the recorded sound of the AAR.
 - The trainer lets the trainees use the different perspectives from which a scenario can be reviewed in the AAR. For example, the trainer shows the perspective of the suspect to show when contact was made and how trainees entered the room.
- The trainer familiarises himself with the buttons and possibilities of the AAR. The trainer ensures that they can recall relevant moments in the scenarios quickly and from the desirable perspectives. As such, trainees are not distracted by scrolling through the timeline during the feedback.
 - The trainer involves the role-player to give feedback to trainees. For instance, how the role-player experienced the instructions from the trainees during the scenario (*“what did you hear and understand the trainees say?”*).
 - The trainer performs the AAR with part of the group, while the other half trains, and then rotates the groups accordingly.
 - The trainer adds a pain stimulus to the VR training to provide instant feedback on performance. This has been shown to enhance the quality of learning and the perceived level of stress.

Include an appropriate pain stimulus to the VR-Training in order to enhance the learning quality and level of perceived stress. Let the trainees choose from a level of light, medium, hard according to their own preferences. As in marking cartridges training choosing for a no pain-stimulus training session is not an option. Same applies for role-players.

These guidelines apply only if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant feedback during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.
- The trainer wears a VR-suit in instruction mode and takes over an NPC to provide feedback from the point of view of a bystander or the suspect.

4.3 Didactical guidelines - National Police of the Netherlands (NPN)

Good practices for a clear assignment

- The trainer states the learning objective and explains why this learning objective is relevant for the officers.
- The trainer discusses with trainees how the learning objective aligns with their training schedule.

- The trainer determines the initial situation and indicate the objective of what will be learned in their training.
- The trainer determines the level of skills and knowledge at the end of training (basic, advanced, expert or A,B,C).
- The trainer explains the coherence and the practice relevant context of the training in relation to their function.
- The trainer explains what the goal is that the officers need to achieve in the assignment. The trainer should be clear WHAT the officers need to achieve, not necessarily HOW they need to achieve this goal.
- The trainer explains the goal in such a way that the officers would be able to evaluate afterwards if the goal was achieved or not. In other words, officers can answer with a yes or no to the question whether they have completed the assignment. Of course the quality/efficiency/etcetera can be discussed in more detail and feedbacked on by the trainer, but whether the assignment is completed or not should be unequivocal.
- The trainer explains trainees the benefits and limitations of training in VR (e.g., the use of various avatar skins, no need to dress role-player or trainees in a certain way). The trainer takes into account that trainees may initially struggle with the newness of the VR tool itself.
- The trainer asks trainees to repeat the assignment in their own words to check for understanding before they start.
- Step 1: Apply the acting in explained situation (role play) and step 2: the trainees act independently in a scenario or simulation.
- The trainer makes use of different VR scenarios, while the training assignment remains the same. The trainer can use risk assessment tool (see D4.7) to create different VR scenarios that align with the assignment. For instance, the assignment is every time: “find the armed suspect”. The trainer can create different scenarios for this assignment:
 - The trainer takes advantage of the flexibility of the virtual environments and uses each repetition a different environment with one armed suspect (an apartment, a furniture shop, an open square, an office space, a school etc.)
 - The trainer varies in complexity of the scenario with the armed suspect (few or many people in the environment, transparent space or space with many obscured/hidden areas, suspect armed with a knife or with a machine gun, many stress factors (children present, dark space, loud noises) or no additional stress factors, etc.
- Trainer asks trainees to repeat/recall what their assignment was before starting the debrief/feedback.
- Be aware that the trainees always should end the training with experience of success, otherwise downsize the assignment.

Good practices for high-quality instruction in VR-training

Instructions to prepare for VR training

- Create a task risk analysis (safety aspects, including mental issues).
- The trainer provides a clear overview of security measures in VR training (e.g., physical contact is not possible, a code word to immediately stop a scenario and possibilities of motion sickness).
- The trainer gives trainees a clear overview of what to expect from a VR environment and what tools are available in the VR environment (e.g., NPCs options and how to speak to them, role-player and how to interact with them).
- The trainer provides trainees with step-like instructions on how to put the VR gear on. The gear-specific instructions should be specific and explicit when needed. For example, when putting on the headphones: *“put your hand in this position and press on until you hear a click”*. These measures can be reduced depending on the expertise level of the trainees.
- The trainer asks the trainees to help each other with the set-up of the VR gear rather than prepare individually.
- The trainer asks the trainees to line up next to each other (with room to move). The trainer then gives the trainees the signal to start a joint calibration process.
- The trainer asks trainees to indicate if there are technical problems with the VR material after the calibration, for example if they have no image or the calibration does not seem to have worked (no realistic movement). If so, the trainer asks the trainee to communicate the problems to the VR operator.
- The trainer explains the purpose of the instructional scenario (tutorial) if included in the training structure.

Instructions during the VR training

- The trainer gives clear commands to trainees when they can put on and take off the visors and headphones to ensure that trainees can follow instructions.
- The trainer provides trainees with training instructions about the structure of the training, learning objectives, and what level of difficulty they can expect.
- The trainer briefs trainees with general dispatch information but does not give away how to handle the situation (*“proceed according to what the situation call for”*).
- The trainer keeps the relevant points that trainees need to pay attention to during the scenario very limited. The trainer gives the trainees concise and single points to focus on, such as *“avoid crossfire”* or *“make sure you scan the entire room by running the walls”* or *“as a group, always keep your six”*. As a general rule of thumb no more than three points of attention should be given in training, but as the novelty of the VR training tool requires a large amount of the trainee’s mental capacity in VR even down tune to one or two.
- The trainer tailors the instruction to the capabilities and developmental stage of the trainees. The trainer builds up the instruction in terms of the number of points on which the trainees must concentrate during the scenario. For example, start with one or two focus points (make sure you scan the whole room by running the walls" and "as a group always keep your six"). If the trainees are successful, the trainer can give the trainees a new focus point ("avoid crossfire"), etc.

- The trainer uses the possibilities of VR to give implicit instruction rather than a specific and step-by-step verbalisation of what to do or what went right and wrong. The trainer can build a self-explanatory scenario, giving clear cues in VR (as is done in gaming) and punishing/rewarding in the VR scenario for doing wrong/good (e.g., having an NPC or role-player come from behind if the group does not keep a 360 degree overview).
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.
- The trainer ensures the role-player's instruction is not overheard by trainees to prevent them from already knowing what is going to happen
- The trainer gives the role-player instruction according to the performance of trainees in previous scenario(s).

This guideline only applies if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant instructions or cues to trainees during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.

Good practices for a well-designed practice situation

- The trainer checks before using VR if there are any arguments against using VR for the learning objective or that other training methods have clear benefit over VR. For instance, if the intention is to include physical contact, handcuffing, training of communication with micro expression, a different training tool would support this practice better. Is the goal to bring together and apply different skills in one scenario and to learn tactical behaviour, or if the trainees would benefit from quick variations in training, then VR might be the ideal solution to go for.
- The trainer selects training environments in VR that trainees may encounter on duty (**realistic environment: realistic core elements are buildings, people, public domain and vehicles.**)
- The trainer selects scenarios in VR that present tasks and challenges that trainees may encounter on duty (realistic problem).
- The trainer ensures that in VR trainees can execute their tasks and find solutions to the challenge that are similar to tasks and solutions required on duty (realistic solutions).
- The trainer ensures that trainees have access to the same tools as in real-life, for instance, if a trainee carries a taser in real-life, the trainee should be able to carry taser in the VR belt as well.
- The trainer ensures that the number of trainees in a team is representative for the task and realistic for real-life performance (e.g., by how many trainees are the tasks and procedures expected in the VR scenarios normally performed in real-life)?
- The trainer ensures that the solutions provoked are as realistic as possible and achievable in VR. For instance, having a role-player acting as a suspect and giving the instruction to use physical force or resistance would not be useful as this requires a solution that cannot be performed by the officer in VR such as self-defence and physical arresting skills.

- The trainer selects scenarios according to the experience and level of expertise of trainees, properly scaffolding learning experiences to fit the level of the trainees. Clearly, special forces will work with more complex scenarios than police academy recruits, and the aim should be to practice near/around the zones of proximal development of the trainees.
- The trainer checks whether certain pitfalls of VR can be avoided in the training; for example, are stairs a necessary part of the training? And is it necessary that doors are closed in a VR scenario or can they already be open? (Since executions of the stair movement and opening doors are not yet experienced as realistic and natural by the trainees).
- By controlling or directing the responses of role-players and NPCs on the fly and in correspondence with the behaviour of the trainee, the trainer can foster trainees' beliefs in their capabilities to perform an action successfully. For instance, when the trainee performs well, make sure the role-player or NPC rewards the behaviour of the trainee thus providing the experience of success to the trainee. If trainees consistently fail, and the trainer fears that motivation and confidence will be lost in trainees, they may choose to simplify the scenario or adapt behaviour of the role player/NPC to pick trainees motivation back up again.
- The trainer avoids familiarizing the trainees with the training environment, since in reality officers constantly encounter new and unfamiliar situations and it is important for the transfer of skills that the skills are constantly applied in new contexts. Therefore, the trainer adapts the scenario and the environment from repetition to repetition (e.g. from an outdoor scenario in the car park in daylight to an outdoor scenario on a busy road at night; placing and removing walls and doors can be done quickly by the VR operator).
- The trainer ensures that no repetition of a scenario is exactly the same as the previous since in reality no situation is the same as another. Therefore the trainer adjusts role-player instructions from repetition to repetition (e.g., instructing the role-player to act with weapon in one scenario and without a weapon in the next repetition).
- The trainer makes a quick analysis of what is needed in the next repetition or practice situation depending on the trainees' performance. The trainer then adapts the scenario (the environment, the behaviour of the role-players or NPCs, the assignment for the trainees, etc) to meet the needs. For example, if the performance of the team shows the trainer that the trainees do not maintain a 360 overview of the situation while processing, the next environment, the behaviour of the role-players or the assignment should force the trainees to better maintain their 360 overview. For example, by placing trainees in an area where threats can come from all directions, by placing NPCs in places that they would typically miss if they were sloppy with the 360 view, etc.
- The trainer ensures that the practice situation forces or invites the trainees to act in a certain way, without the need for explicit instruction. For example, a scenario where a perpetrator harms an individual until the perpetrator is stopped forces the trainees to speed up. Or if the environment is very cluttered (lots of people, stuff or spaces) it forces the trainees to scan the environment in a very focused and structured way.
- The trainer guide the trainees in training under pressure, by using stressors as time-pressure, difficulty level, pain anxiety, darkness or auditory limitations (limited communication).

Good practices for model learning

- The trainer can use a short 'Time-Out' moment for a mini-demonstration to show how skills should be used in the scenario
 - The talk (trainer) / the picture (trainer)/ the act (trainee)
 - Short videos where skills and knowledge are applied correctly
 - Pictures where skills or procedures are applied correctly
- The trainer makes use of trainees as peer observational models (instead of solely relying on expert models).
 - For instance, during a training with four, two trainees are executing the training scenario in VR while the other two trainees can observe the performance on an external screen (AAR) using various viewing perspectives and a variety of abstract performance indicators (e.g., line of fire, movement paths, field of view, performance statics).
 - For instance, the trainer asks the trainees to designate a commander within the group who will lead the scenario execution and after-action review. By having different commanders within the group during the course of the training, trainees can learn from each other's approaches and operating methods.
 - For instance, one of the trainees serves as a peer model on how to take off the gear in a procedural fashion (step-by-step).
- The trainer gives trainees a clear and specific viewing task related to the training or learning objective. For example, trainees may watch the execution of a scenario in three different situations (e.g. observing on the AAR screen while others are training, observing as "ghosts" in the VR environment while others are training or during a joint after action review). In all three situations, the trainer should give the trainees a clear and specific viewing task (e.g. instruct them to watch for decisive DMA moments; or evaluate a particular tactical skill; or observing a particular member of the group). This increases focus, steers the direction of the model's learning and ensures that the trainees observe the model's behaviour.
- The trainer uses the VR "Ghost Mode". Trainer or trainee can actively be part of the virtual environment as a "ghost" and observe the other trainees' performance in the scenario without being visible to them.
- The trainer uses the AAR as video feedback to allow the trainee to learn from their own implementation as a model.

This guideline applies only if the trainer is wearing a VR suit:

- The trainer serves as an expert model for demonstration of certain skills or behaviours in the VR environment. The trainer can demonstrate sub-skills or sub-movements acting visible in the virtual environment.

Good practices for variation and differentiation

- The trainer ensures that they have a predetermined selection database of VR environments (e.g. a minimum of three different virtual environments to vary easily and quickly in practice situations).
- To achieve variation and create a new practice situation, the trainer changes the context of the virtual environment for each repetition:
 - Through environmental changes: location variation (an apartment, a furniture shop, an open square, an office space, a school etc.) and additional objects in the environment, etc.
 - Through different starting points for trainees and role-players in the same virtual environment. For instance, the trainees start in the same building in one repetition at the main entrance and in the next repetition they start at the back entrance and the position of the role-player is in the first repetition in the kitchen and in the next repetition in the living room.
- To achieve differentiation, the trainer varies the level of complexity per repetition:
 - Differentiation through NPC: the trainer changes NPC level of aggression or changes their appearance, few or many NPCs in the environment, NPCs with harder to interpret behaviour, more or less responsive NPCs, etcetera.
 - Differentiation through role-players: the trainer changes the behavioural instruction of the role-players, changes their appearance by giving them a different VR skin, changes the speed at which they act or has the role-player carry a knife in one repetition and a machine gun in the next.
 - Differentiation through manipulating objects: the trainer changes presence and appearance of weapons (weapons “hidden under a pile of clothes on a desk, behind the back of an NPC, unusual weapons like a hammer etc.), using transparent space or space with many obscured/hidden area.
- The trainer asks the role-player to adapt the course of the scenario on the fly to take advantage of the opportunity to not be visible or audible to trainees as a trainer. Because the trainers’ instructions to the role-player are invisible and inaudible to the trainees even during the scenario, trainers have the freedom to adjust role-player behaviours to their liking (e.g., having the role-player cursing at the trainee). Adjusting role-player behaviour on the fly can be done through wireless headset/microphone communication between trainer and role-player or by physically moving or guiding the role-player to the intended position.
- The trainer creates an increasingly challenging environment for a trainee to have a positive experience and adjust the level of difficulty to the capacities and developmental phase of the trainee.
 - The trainer monitors the trainee’s success by looking at the performance indicators (e.g., DMA-specific behaviours, tactical behaviours, etc.) using the in-Action Feedback that VR offers.
 - If the training seems too simple for the trainee, the trainer up-scales the level of complexity directly by activating additional stress cues or changing the context (e.g., night-time, medium to high level of threat, presence of weapons).

- If the trainee starts to make mistakes, the trainer may want to down-scale the level of complexity for optimal learning (e.g., daytime, low to medium level of threat).

- The trainer can differentiate in the acting roles, for example:

The actor (handling and communication), the safety observer (awareness and safety while handling) and the second observer (watch and walk). The actor is a complex role, the observer is simpler and the second observer is a starter.

- The trainer can also variate in subjects and objects:

Subjects: individuals: big person, crazy person, fat person, sitting person, etc. Groups: hooligans, protesters, bikers, youth etc.

Objects: Vehicles: bus, van, car, truck, bike, etc. Weapons: stick, baseball, pipe, umbrella, knives, firearms (could also be a differentiation) Doors: bard door, turning inward, turning outward.

Good practices for self-regulation of learning

- The trainer asks the trainees to handle and position the gear on the gear belt themselves, instead of having fixed positions. The trainees can, for example, pick up the tools (weapon, pepperspray, etc.) from a desk and place it on the belt however they like.
- The trainer lets trainees practice with use of the gear on the belt in real-life to ensure that it coincides with their real-life experience. For example, the trainer gives trainees time to familiarize themselves with the VR replica weapons in real life (how to hold it, reload, etc.).
- The trainer allows trainees to choose which training tools they would like to use in addition to the basic equipment. For example, trainees that are carrying a taser or rifle in daily practice must be able to wear a taser or rifle in VR training.
- The trainee practice in their daily uniform (as much as possible: vest, helmet, motorgear, etc.) with carrying their attributes (weapons and other stuff) as they regular do and in line with the training objective.
- The trainer ensures that trainees have previous practical knowledge of the relevant skills to apply them in the VR training. The trainer asks the group which knowledge and skills they possess (e.g., what is your current level/ability in your opinion?).
- The trainer asks the group whether they have specific learning objectives they would like to focus on in the VR training (e.g., what would you like to learn or practice today?).
- The trainer asks the trainees if there is anything they would like explained or repeated before starting in the VR environment. For example, specific procedures and movements can be practiced in dry runs with the goggles up.
- The trainer allows the trainee to decide what role they want to play in the scenario. The trainee can, for example, decide to play the perpetrator and give feedback on the performance from the

perpetrator perspective in the feedback phase.

- The trainer asks how and on which aspects the trainees would like to receive feedback after the scenari
- The trainer gives the instruction to trainees that they can stop and pause the scenario at any time. For example, to quickly repeat and re-practice a certain moment in the scenario or to evaluate in between.
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.
- As part of the training, the trainer offers the opportunity to read action frameworks beforehand.
- The trainee has the option to indicate how and on what basis he/she would like to be coached.
- The trainer invites trainees to reflect about their first experience after the initial instruction scenario, and asks what their expectations and needs are for the further scenarios.
- The trainer asks trainees whether they would like to repeat an attempt after the scenario.
- The trainer allows trainees to vary difficulty in practice attempts by asking trainees whether they would like to adjust the level of complexity of the scenario.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the execution of the scenario.
- The trainer asks the group to reflect on their own decisions based on what is visually observed on the AAR (e.g., the trainees explain why they behaved in the way they did).
- The trainer asks trainees to reflect on their communication on the basis of the sound recorded by the AAR.
- The trainer provides time for questions of trainees.
- The trainer lets trainees decide from whom they want feedback. For example, they can choose a colleague that was nearby or who they know to be an expert on the learning objective, or they can choose feedback from trainer.
- The trainer asks trainees to select parts of the scenario they would like to review.
- The trainer asks trainees to choose an angle or perspective they would like to review their performance from. The trainees can, for example, indicate to review the scenario from the aggressor's perspective.
- The trainer lets trainees “re-experience” the operation by giving them the AAR controller for a walkthrough in the AAR.

Good practices for constructive and motivating feedback

- The trainer names good results and improvements.
- The trainer names commitment and efforts of trainees.
- The trainer gives feedback after successful scenario attempts.
- The trainer uses the following feedback structure:
 - Where am I going? What are the learning goals? (e.g., disarming a suspect, doing better than previous repetition).
 - How am I going? What does the evidence tell us about performance? (e.g., we disarmed the suspect to the expected standard, the task was performed more successfully than the previous repetition, and a part of the task that went very well was that we avoided crossfire, a part that went less well is that we moved a little too slowly).
 - Where to next? What learning activities should we do to make better progress? (e.g., we will train to act faster and thus increase the pace of the procedure).
- The trainer evaluates directly during the training when things do not go well under the motto: mistakes are learning tools. Realize that at the end of the repetition your opinion (“well done”) works motivational for the students.
- The trainer gives the trainees time to reflect on their performance and discuss with each other (e.g., trainees discuss how they can improve their movements in tactical procedures).
- The trainer asks each trainee to give their impression of the scenario and describe their own decisions (trainees explain why they behaved in the way they did).
- The trainer formulates feedback in terms of development, something that can be improved. For example, the trainer accompanies feedback with action suggestions or suggestions for learning activities to improve (where to next?).
- The trainer provides time for trainees to ask questions.
- The trainer ensures that the feedback relates to learning objectives of the training:
 - what are the relevant moments? (and why these specifically for the learning objectives of the training);
 - what information is relevant?; (and how is this relevant specifically for the learning objectives of the training)
- The trainer substantiates the feedback with careful observation and analysis of the video evidence provided by the VR After-Action Review (AAR):
 - The trainer makes the trainees review relevant parts of the scenario by giving them the opportunity to pause and play the AAR. The trainer asks the group to reflect on their own decisions based on what is visually observed on the AAR.
 - The trainer lets trainees review the statistical feedback presented in the AAR such as number of shots fired and targets hit, bystanders flagged, etc.
 - The trainer asks the trainees how they perceived their stress levels throughout the scenario and if they want to see the stress levels reflected in the AAR.
 - The trainer gives the trainees feedback on their communication by using the recorded sound of the AAR.

- The trainer lets the trainees use the different perspectives from which a scenario can be reviewed in the AAR. For example, the trainer shows the perspective of the suspect to show when contact was made and how trainees entered the room.
- The trainer familiarises himself with the buttons and possibilities of the AAR. The trainer ensures that they can recall relevant moments in the scenarios quickly and from the desirable perspectives. As such, trainees are not distracted by scrolling through the timeline during the feedback.
- The trainer asks trainees to lift their VR head mounted display when performing the debrief and providing feedback.
- The trainer involves the role-player to give feedback to trainees. For instance, how the role-player experienced the instructions from the trainees during the scenario (*“what did you hear and understand the trainees say?”*).
- The trainer performs the AAR with part of the group, while the other half trains, and then rotates the groups accordingly.
- The trainer adds a pain stimulus to the VR training to provide instant feedback on performance. This has been shown to enhance the quality of learning and the perceived level of stress.
 - In the end of the after-action review the trainer can ask as summary the students the next questions: So what went well? – What went less well? – How can I do better next time?
 - Short and powerful evaluation at the end of the training, choose the subjects in context of the results (skills, procedures, training targets) or in context of the process (start, collaboration, performance, final situation).

These guidelines apply only if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant feedback during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.
- The trainer wears a VR-suit in instruction mode and takes over an NPC to provide feedback from the point of view of a bystander or the suspect.
 - The trainer evaluates directly during the training when things do not go well under the motto: mistakes are learning tools. Realize that at the end of the repetition your opinion (*“well done”*) works motivational for the students.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the review of the scenario.
- The trainee has the opportunity of feedback moments and assessment moments (assessments whether the required competences are met).

4.4 Didactical guidelines - Swedish Police Authority (SPA)

The Swedish police have drawn up guidelines for how education, further training should be conducted within the authority. These must be governing for all types of education and learning activities, regardless of whether they take place via home studies or local studies, theoretical or practical training.

Competence development efforts must be goal-directed, education and further training or just a training session must have explicit learning objectives. The learning objectives must be connected with the learning activities and forms of assessment, formative and summative, as well as feedback and/or examination. The feedback must be forward-looking, “feed-forward”, and directed towards the learning objectives. In other words, there must be a constructive alignment, “a common thread”.

The goals describe what the participant should be able to do after completion of education, further training or a training session. They can be divided into knowledge, skill evaluation and approach/attitude ability.

The purpose is that the orientation should be a support for trainers, managers and other personnel within the Police Agency who work with competence development. It must create the conditions for systematicity, uniformity and consensus.

The focus is based on an understanding-based approach to adult learning, which means that learning is seen as a process based on the participant's own experiences, existing knowledge and skills. How they perceive the context and finally how we create a new understanding by pitting previous understanding against new.

An understanding-based perspective on learning has the best conditions to form participants who can reflect on their competence, put it into different contexts and independently evaluate and develop their knowledge and skills adapted to a changing world.

The focus is further based on six main didactic principles that favour learning. In combination with each other, they form a good starting point for the development of different didactic methods for a given need.

The principles are; that adults learn

- By doing, being active in your own learning
- Through the context and based on different understandings of it
- Through dialogue and cooperation with others
- Through motivational tasks at a participant-appropriate level

- By receiving feedback on their performance
- By reflecting on their learning

Is model learning used?

Is there a clear assignment?

Is there a well-designed practice situation?

Is there constructive and motivation feedback?

Is there high-quality instruction?

Is there possibility for self-management of the learning process?

Is there variation and differentiation?

VR could, in the future, be a pedagogical tool, a type of learning activity, to reach and challenge the participant in what is to be learned. Since Swedish police have not had any field trials, the questions above are somewhat a bit difficult to answer. Of the VR field trials in which we have been involved as "observers", however, we can state the following based on our guidelines for pedagogical focus:

VR as a pedagogical tool could be targeted based on knowledge, skill evaluation and approach/attitude ability depending on what is to be trained and who is to be trained.

VR could be used both in a beginner's context, in basic training and in further training for experienced police employees, both civilians and police officers.

The VR environment and the training can be easily adapted, made more difficult and simplified for the target group/individual being trained at the time. An understanding-based approach where knowledge is seen as a process and the participant's own experiences, knowledge and skills can be used.

If you look at the six didactical principles for adult learning, the following can be observed through VR training:

- **By doing, being active in your own learning**

In the VR training, more participants than those actually practicing can be involved. By observing and giving feedback to their peers in various forms, high activity is created. Different types of learning styles are activated in the participant depending on the role in the VR training that one has. Seeing and listening to other participants interspersed with being able to practice and do yourself challenges several senses and gives the participant more things to think about and reflect on.

- **Through the context and different understanding of this**

In the VR environment, you can recreate and imitate some of the environments/events that a police employee rarely can or gets the opportunity to practice in or on. The participant's existing knowledge and skills, which are usually trained in fragments, can thus be tested in a whole, similar to scenario training.

- **Through dialogue and cooperation with others**

In the VR environment, where the participant has different roles in the training, one's own knowledge and skills can be compared to that of others, which gives more dimensions to the learning. AAR as an evaluation tool alt. reflection questions and the subsequent seminar, as well as, the opportunity to experience and see yourself and others via recordings, provide good conditions for having something to talk about/reflect on and about.

- **Through motivational tasks at a participant-appropriate level**

In the VR environment, you can create authentic, life-like learning activities that can otherwise be difficult to practice and imitate at times. The level of challenge can be varied as well as the level of support from the trainer leading the training. What the participant is educated/trained in must have a clear relevance and be focused on an actual ability that the participant is expected to have in their work, in their function.

- **By receiving feedback on their performance**

The VR training can be easily recorded and played back for the participant. Feedback, feed-forward, from both other participants and trainers should be based on the goal and assessment criteria of the training. In this way, the participant can self-evaluate their performance in relation to the knowledge and skills they believe/seem to have. In this way, the feedback focuses on the learner's understanding of his own learning process. The VR training also gives trainers the opportunity to formatively evaluate the participant's continued learning needs.

- **By reflecting on their learning**

The VR training could be a good supplement that gives the participant the opportunity to reflect on their own learning. Being able to have several different roles in the VR training, practitioner, observer, character (perpetrator, witness, etc.) gives different perspectives. Being able to vary with different degrees of difficulty, redo/retry, twist and turn an event/a scenario, change the conditions, increase/decrease the stress factors challenges the participant in their own learning process.

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4.5 Didactical guidelines - Berlin Police (BP)

Good practices for a clear assignment

- The trainer states the learning objective and explains why this learning objective is relevant for the officers.
Choose a clear assignment to make the pre-training or actual training experience relevant for your trainees. If possible, let your trainees reflect on the question of learning objectives and relevance for themselves and the organisation.
- The trainer discusses with trainees how the learning objective aligns with their training schedule.
Reassure your students that they have been trained and prepared for this exact scenario/challenge and are ready for it.
- The trainer explains what the goal is that the officers need to achieve in the assignment. The trainer should be clear WHAT the officers need to achieve, not necessarily HOW they need to achieve this goal.
Explain the scenario/assignment goals using professional language or tactical radio communication terminology. If possible, do not explain how the trainees can achieve these.
- Ask your trainees to repeat/recall what their assignment was before starting the debrief/feedback.
- The trainer makes use of different VR scenarios, while the training assignment remains the same. The trainer can use risk assessment tool (see D4.7) to create different VR scenarios that align with the assignment. For instance, the assignment is every time: “find the armed suspect”. The trainer can create different scenarios for this assignment:
 - The trainer takes advantage of the flexibility of the virtual environments and uses each repetition a different environment with one armed suspect (an apartment, a furniture shop, an open square, an office space, a school etc.)
 - The trainer varies in complexity of the scenario with the armed suspect (few or many people in the environment, transparent space or space with many obscured/hidden areas, suspect armed with a knife or with a machine gun, many stress factors (children present, dark space, loud noises) or no additional stress factors, etc.

Make use the flexibility of the VR-Environment to run one successful scenario several times, with the same assignment but with differing difficulty levels or scenario outcomes. Play “what if” by including objective stressors and by adjusting role-player behaviour. Do not overpower your trainees but challenge them for new successes.

Use this approach, especially for high-performing groups.

If trainees have achieved a certain level of prowess, use different VR environments on the same assignment. For example a traffic stop with an armed suspect (assignment is “vehicle with armed suspect”) on a lonely road. Second the same traffic stop on a city road at night and with low traffic. Third the same traffic stop on a city road with many pedestrians and traffic around.

Use this approach especially for high-performing groups.

Good practices for high-quality instruction in VR-training

Instructions to prepare for VR training

- The trainer provides a clear overview of security measures in VR training (e.g., physical contact is not possible, a code word to immediately stop a scenario and possibilities of motion sickness).
 Implement a “safety coach” and provide clear rules of engagement on what is possible and what is forbidden in VR-Training. Set up an emergency procedure including an “Abort Training”-wording in case of emergencies.
- The trainer gives trainees a clear overview of what to expect from a VR environment and what tools are available in the VR environment (e.g., NPCs options and how to speak to them, role-player and how to interact with them)
- The trainer provides trainees with step-like instructions on how to put the VR gear on. The gear-specific instructions should be specific and explicit when needed. For example, when putting on the headphones: *“put your hand in this position and press on until you hear a click”*. These measures can be reduced depending on the expertise level of the trainees.
- The trainer asks the trainees to help each other with the set-up of the VR gear rather than prepare individually.
- The trainer asks the trainees to line up next to each other (with room to move). The trainer then gives the trainees the signal to start a joint calibration process.
- The trainer asks trainees to indicate if there are technical problems with the VR material after the calibration, for example if they have no image or the calibration does not seem to have worked (no realistic movement). If so, the trainer asks the trainee to communicate the problems to the VR operator.
- The trainer explains the purpose of the instructional scenario (tutorial) if included in the training structure.

Instructions during the VR training

- The trainer gives clear commands to trainees when they can put on and take off the visors and headphones to ensure that trainees can follow instructions.
- The trainer provides trainees with training instructions about the structure of the training, learning objectives, and what level of difficulty they can expect.
- The trainer briefs trainees with general dispatch information but does not give away how to handle the situation (*“proceed according to what the situation call for”*).
- The trainer keeps the relevant points that trainees need to pay attention to during the scenario very limited. The trainer gives the trainees concise and single points to focus on, such as *“avoid*

crossfire” or “make sure you scan the entire room by running the walls” or “as a group, always keep your six”. As a general rule of thumb no more than three points of attention should be given in training, but as the novelty of the VR training tool requires a large amount of the trainee’s mental capacity in VR even down tune to one or two.

- The trainer tailors the instruction to the capabilities and developmental stage of the trainees. The trainer builds up the instruction in terms of the number of points on which the trainees must concentrate during the scenario. For example, start with one or two focus points (make sure you scan the whole room by running the walls" and "as a group always keep your six"). If the trainees are successful, the trainer can give the trainees a new focus point ("avoid crossfire"), etc.
- The trainer uses the possibilities of VR to give implicit instruction rather than a specific and step-by-step verbalisation of what to do or what went right and wrong. The trainer can build a self-explanatory scenario, giving clear cues in VR (as is done in gaming) and punishing/rewarding in the VR scenario for doing wrong/good (e.g., having an NPC or role-player come from behind if the group does not keep a 360 degree overview).
- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification
- The trainer ensures the role-player's instruction is not overheard by trainees to prevent them from already knowing what is going to happen
- The trainer gives the role-player instruction according to the performance of trainees in previous scenario(s).

This guideline only applies if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant instructions or cues to trainees during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.

Good practices for a well-designed practice situation

- The trainer checks before using VR if there are any arguments against using VR for the learning objective or that other training methods have clear benefit over VR. For instance, if the intention is to include physical contact, handcuffing, training of communication with micro expression, a different training tool would support this practice better. Is the goal to bring together and apply different skills in one scenario and to learn tactical behaviour, or if the trainees would benefit from quick variations in training, then VR might be the ideal solution to go for.
- The trainer selects training environments in VR that trainees may encounter on duty (realistic environment).

- The trainer selects scenarios in VR that present tasks and challenges that trainees may encounter on duty (realistic problem).
- The trainer ensures that in VR trainees can execute their tasks and find solutions to the challenge that are similar to tasks and solutions required on duty (realistic solutions).
- The trainer ensures that trainees have access to the same tools as in real-life, for instance, if a trainee carries a taser in real-life, the trainee should be able to carry taser in the VR belt as well.
- The trainer ensures that the number of trainees in a team is representative for the task and realistic for real-life performance (e.g., by how many trainees are the tasks and procedures expected in the VR scenarios normally performed in real-life)?
- The trainer ensures that the solutions provoked are as realistic as possible and achievable in VR. For instance, having a role-player acting as a suspect and giving the instruction to use physical force or resistance would not be useful as this requires a solution that cannot be performed by the officer in VR such as self-defence and physical arresting skills.
 Scenario solutions must be in compliance with laws and use of force policies of your organisation. Plan for proper “exit points” in specific use of force situations by using “coaching in process-techniques” or “time-outs” when trainees decided for the correct action that cannot be executed properly/safely in VR-Training.
 Plan for a respective real world training in addition to the VR-Experience.
- The trainer selects scenarios according to the experience and level of expertise of trainees, properly scaffolding learning experiences to fit the level of the trainees. Clearly, special forces will work with more complex scenarios than police academy recruits, and the aim should be to practice near/around the zones of proximal development of the trainees.
- By controlling or directing the responses of role-players and NPCs on the fly and in correspondence with the behaviour of the trainee, the trainer can foster trainees’ beliefs in their capabilities to perform an action successfully. For instance, when the trainee performs well, make sure the role-player or NPC rewards the behaviour of the trainee thus providing the experience of success to the trainee. If trainees consistently fail, and the trainer fears that motivation and confidence will be lost in trainees, they may choose to simplify the scenario or adapt behaviour of the role player/NPC to pick trainees motivation back up again.
- The trainer avoids familiarizing the trainees with the training environment, since in reality officers constantly encounter new and unfamiliar situations and it is important for the transfer of skills that the skills are constantly applied in new contexts. Therefore, the trainer adapts the scenario and the environment from repetition to repetition (e.g. from an outdoor scenario in the car park in daylight to an outdoor scenario on a busy road at night; placing and removing walls and doors can be done quickly by the VR operator).
- The trainer ensures that no repetition of a scenario is exactly the same as the previous since in reality no situation is the same as another. Therefore the trainer adjusts role-player instructions from repetition to repetition (e.g., instructing the role-player to act with weapon in one scenario and without a weapon in the next repetition).
 And the intensity of the role player's actions is determined by the situation.

If your trainees concluded a scenario successfully, repeat the scenario with differing role-player behaviour. From non-cooperative to cooperative, from submissive to aggressive etc. in alignment with the training goals and assignment. This will properly train them on the process of decision making and acting in compliance with their daily duty and in compliance with the use of force policies of their organisation.

Do not try to win but challenge them on their individual skill level and in accordance with their work profile.

In addition this will prevent training them only in one directional use-of-force or only de-escalating behaviours.

- The trainer makes a quick analysis of what is needed in the next repetition or practice situation depending on the trainees' performance. The trainer then adapts the scenario (the environment, the behaviour of the role-players or NPCs, the assignment for the trainees, etc) to meet the needs. For example, if the performance of the team shows the trainer that the trainees do not maintain a 360 overview of the situation while processing, the next environment, the behaviour of the role-players or the assignment should force the trainees to better maintain their 360 overview. For example, by placing trainees in an area where threats can come from all directions, by placing NPCs in places that they would typically miss if they were sloppy with the 360 view, etc.
The aim is to bring the participants to new learning experiences through the adjustments.

I would not advise to encourage trainers to do that because it might lead to a trainer vs trainees smart ass atmosphere of the bad old times. 😊

I would advise to make the analysis (feedback, after action review) and ask the trainees if they would like to experience the effect of the problem. This gives them the chance to “save face” and have a successful training repetition.

- The trainer ensures that the practice situation forces or invites the trainees to act in a certain way, without the need for explicit instruction. For example, a scenario where a perpetrator harms an individual until the perpetrator is stopped forces the trainees to speed up. Or if the environment is very cluttered (lots of people, stuff or spaces) it forces the trainees to scan the environment in a very focused and structured way.
This corresponds to the real situation conditions that can be found in operational situations.
Design your practice situation in a way that it allows fluid and realistic decision making and acting processes in combination with the application of present skills for your trainees.

Good practices for model learning

- The trainer makes use of trainees as peer observational models (instead of solely relying on expert models).
If possible, use your trainees as positive role models for the training group. Point out good practices or skills demonstrated in order to raise trust and motivation with your training group.
 - For instance, during a training with four, two trainees are executing the training scenario in VR while the other two trainees can observe the performance on an external screen (AAR) using various viewing perspectives and a variety of abstract

performance indicators (e.g., line of fire, movement paths, field of view, performance statics).

Let training sessions be monitored by inactive parts of the group.

- For instance, the trainer asks the trainees to designate a commander within the group who will lead the scenario execution and after-action review. By having different commanders within the group during the course of the training, trainees can learn from each other's approaches and operating methods.

If possible designate a “Teamleader” who is also in charge of parts of the AAR-Feedback. Rotate the Teamleader function as often as possible if the trainees are successful in their performance.

- For instance, one of the trainees serves as a peer model on how to take off the gear in a procedural fashion (step-by-step).
- The trainer gives trainees a clear and specific viewing task related to the training or learning objective. For example, trainees may watch the execution of a scenario in three different situations (e.g. observing on the AAR screen while others are training, observing as "ghosts" in the VR environment while others are training or during a joint after action review). In all three situations, the trainer should give the trainees a clear and specific viewing task (e.g. instruct them to watch for decisive DMA moments; or evaluate a particular tactical skill; or observing a particular member of the group). This increases focus, steers the direction of the model's learning and ensures that the trainees observe the model's behaviour.

Provide inactive trainees with sophisticated monitoring assignments for the AAR and feedback.

- The trainer uses the AAR as video feedback to allow the trainee to learn from their own implementation as a model.

This guideline applies only if the trainer is wearing a VR suit:

- The trainer serves as an expert model for demonstration of certain skills or behaviours in the VR environment. The trainer can demonstrate sub-skills or sub-movements acting visible in the virtual environment.

Good practices for variation and differentiation

- The trainer ensures that they have a predetermined selection database of VR environments (e.g. a minimum of three different virtual environments to vary easily and quickly in practice situations).
- To achieve variation and create a new practice situation, the trainer changes the context of the virtual environment for each repetition:
 - Through environmental changes: location variation (an apartment, a furniture shop, an open square, an office space, a school etc.) and additional objects in the environment, etc.
 - Through different starting points for trainees and role-players in the same virtual environment. For instance, the trainees start in the same building in one repetition at the main entrance and in the next repetition they start at the back entrance and the

position of the role-player is in the first repetition in the kitchen and in the next repetition in the living room.

Also through additional stress stimuli selected and adapted to the situation.

- To achieve differentiation, the trainer varies the level of complexity per repetition:
 - Differentiation through NPC: the trainer changes NPC level of aggression or changes their appearance, few or many NPCs in the environment, NPCs with harder to interpret behaviour, more or less responsive NPCs, etcetera.
 - Differentiation through role-players: the trainer changes the behavioural instruction of the role-players, changes their appearance by giving them a different VR skin, changes the speed at which they act or has the role-player carry a knife in one repetition and a machine gun in the next.
 - Differentiation through manipulating objects: the trainer changes presence and appearance of weapons (weapons “hidden under a pile of clothes on a desk, behind the back of an NPC, unusual weapons like a hammer etc.), using transparent space or space with many obscured/hidden area.

- The trainer asks the role-player to adapt the course of the scenario on the fly to take advantage of the opportunity to not be visible or audible to trainees as a trainer. Because the trainers’ instructions to the role-player are invisible and inaudible to the trainees even during the scenario, trainers have the freedom to adjust role-player behaviours to their liking (e.g., having the role-player cursing at the trainee). Adjusting role-player behaviour on the fly can be done through wireless headset/microphone communication between trainer and role-player or by physically moving or guiding the role-player to the intended position.

This option should be chosen very carefully and in order to ensure a success for the trainees.

- The trainer creates an increasingly challenging environment for a trainee to have a positive experience and adjust the level of difficulty to the capacities and developmental phase of the trainee.
 - The trainer monitors the trainee’s success by looking at the performance indicators (e.g., DMA-specific behaviours, tactical behaviours, etc.) using the in-Action Feedback that VR offers.
 - If the training seems too simple for the trainee, the trainer up-scales the level of complexity directly by activating additional stress cues or changing the context (e.g., night-time, medium to high level of threat, presence of weapons).
 - If the trainee starts to make mistakes, the trainer may want to down-scale the level of complexity for optimal learning (e.g., daytime, low to medium level of threat).

Good practices for self-regulation of learning

- The trainer asks the trainees to handle and position the gear on the tactical belt themselves, instead of having fixed positions. The trainees can, for example, pick up the tools (weapon, pepperspray, etc.) from a desk and place it on the belt however they like.

- The trainer lets trainees practice with use of the gear on the belt in real-life to ensure that it coincides with their real-life experience. For example, the trainer gives trainees time to familiarise themselves with the VR replica weapons in real life (how to hold it, reload, etc.).
- The trainer allows trainees to choose which training tools they would like to use in addition to the basic equipment. For example, trainees that are carrying an electroshock gun or rifle in daily practice must be able to wear a electroshock gun or rifle in VR training.

Give your trainees some time and space to familiarize themselves with „new gear or use of force tools“ (positioning, handling etc.)

Finally ask your participants whether they are feeling comfortable and „ready to go on the mission“!

Training instruction

- The trainer ensures that trainees have previous practical knowledge of the relevant skills to apply them in the VR training. The trainer asks the group which knowledge and skills they possess (e.g., what is your current level/ability in your opinion?).
- The trainer asks the group whether they have specific learning objectives they would like to focus on in the VR training (e.g., what would you like to learn or practice today?).

Make sure that you have distinctive and predefined training goals and that your scenarios were segmented and designed especially to reach those!

Be sure that your pre-analysis of the trainee group matches the training goals and the scenario.

Make sure by conducting a proper pre-analysis that only trainees enter your scenario who possess a sufficient skillset and knowledge to successfully meet the training goals.

Make sure that you control that learning process by properly deciding on the use of role-players or AI. See to it that both are properly scripted.

- The trainer asks the trainees if there is anything they would like explained or repeated before starting in the VR environment. For example, specific procedures and movements can be practiced in dry runs with the goggles up.
- The trainer allows the trainee to decide what role they want to play in the scenario. The trainee can, for example, decide to play the perpetrator and give feedback on the performance from the perpetrator perspective in the feedback phase.
- The trainer asks how and on which aspects the trainees would like to receive feedback after the scenario.
- The trainer gives the instruction to trainees that they can stop and pause the scenario at any time. For example, to quickly repeat and re-practice a certain moment in the scenario or to evaluate in between.

- The trainer asks trainees whether the dispatch information and scenario descriptions were clear and whether they need further clarification.
- If they make good training progress give your participants the opportunity to shift feedback focus to their specific needs. Give them options for feedback according to their needs to gain more acceptance and motivation.
- Point out to the trainees that in case of failure or underperformance the method of coaching in process and direct repetition cycles will be used.
- Encourage your trainees at any time to question scenario information and simulated despatch radio calls for further vital information in order to have a „clear picture“ on the task at hand and receiving all vital scenario information available.

Training Execution

- The trainer **invites trainees to reflect** about their **first experience** after the initial instruction scenario and asks what their expectations and needs are for the further scenarios.
- The trainer asks **trainees whether** they would **like to repeat** an attempt after the scenario.
- The trainer allows trainees to **vary difficulty in practice attempts** by asking trainees whether they would like to adjust the level of complexity of the scenario.
- The trainer lets trainees **choose to have help tools** (e.g., line of fire, movement lines visualised in the VR view of the trainees) on or off during the execution of the scenario.

Get feedback from your participants if they feel comfortable with the tutorial or if they need anything more to get „scenario ready“!

Urge your trainees to repeat a „failed“ scenario and encourage them to train at a „difficulty level“ that poses a challenge to them.

After Action Review

First get your trainees to **orate (steam off) their reflections and emotions about what they experienced in the scenario.**

- The trainer asks the group to reflect on their own decisions based on what is visually observed in the AAR (e.g., the trainees explain why they behaved in the way they did).
- The trainer asks trainees to reflect on their communication on the basis of the sound recorded by the AAR.
- The trainer provides time for questions of trainees.
- The trainer asks trainees to select parts of the scenario they would like to review.

- The trainer lets trainees decide from whom they want feedback. For example, they can choose a colleague that was nearby or who they know to be an expert on the learning objective, or they can choose feedback from trainer.
- The trainer asks trainees to choose an angle or perspective they would like to review their performance from. The trainees can, for example, indicate to review the scenario from the aggressor's perspective.

In case of failure urge them to a repetition cycle and make them verbalize their intent for the repetition.

In case of success make them verbalize their intent for the upcoming scenarios.

- The trainer lets trainees “re-experience” the operation by giving them the AAR controller for a walkthrough in the AAR.
- The trainer lets trainees choose to have help tools (e.g., line of fire, movement lines) on or off during the review of the scenario.

Good practices for constructive and motivating feedback

- The trainer names good results and improvements.
- The trainer names commitment and efforts of trainees.
- The trainer gives feedback after successful scenario attempts.
These steps are standard in our training structure
- The trainer uses the following feedback structure:
 - Where am I going? What are the learning goals? (e.g., disarming a suspect, doing better than previous repetition).
 - How am I going? What does the evidence tell us about performance? (e.g., we disarmed the suspect to the expected standard, the task was performed more successfully than the previous repetition, and a part of the task that went very well was that we avoided crossfire, a part that went less well is that we moved a little too slowly).
 - Where to next? What learning activities should we do to make better progress? (e.g., we will train to act faster and thus increase the pace of the procedure).

We would like to implement this structure in our organization!

- The trainer asks each trainee to give their impression of the scenario and describe their own decisions (trainees explain why they behaved in the way they did).

Ask your trainees after the training to give a short individual statement about their performance and decisions. Do this as an “opener” prior to the above mentioned feedback.

- The trainer formulates feedback in terms of development, something that can be improved. For example, the trainer accompanies feedback with action suggestions or suggestions for learning activities to improve (where to next?).

- The trainer provides time for trainees to ask questions.

Ask your trainees if they have any further questions.

- The trainer ensures that the feedback relates to learning objectives of the training:
 - what are the relevant moments? (and why these specifically for the learning objectives of the training);
 - what information is relevant?; (and how is this relevant specifically for the learning objectives of the training)
- The trainer substantiates the feedback with careful observation and analysis of the video evidence provided by the VR After-Action Review (AAR):
 - The trainer makes the trainees review relevant parts of the scenario by giving them the opportunity to pause and play the AAR. The trainer asks the group to reflect on their own decisions based on what is visually observed on the AAR.
 - The trainer asks the trainees how they perceived their stress levels throughout the scenario and if they want to see the stress levels reflected in the AAR.
 - The trainer gives the trainees feedback on their communication by using the recorded sound of the AAR.
 - The trainer lets the trainees use the different perspectives from which a scenario can be reviewed in the AAR. For example, the trainer shows the perspective of the suspect to show when contact was made and how trainees entered the room.

- The trainer familiarises himself with the buttons and possibilities of the AAR. The trainer ensures that they can recall relevant moments in the scenarios quickly and from the desirable perspectives. As such, trainees are not distracted by scrolling through the timeline during the feedback.

- The trainer involves the role-player to give feedback to trainees. For instance, how the role-player experienced the instructions from the trainees during the scenario (*“what did you hear and understand the trainees say?”*).

- The trainer performs the AAR with part of the group, while the other half trains, and then rotates the groups accordingly.

- The trainer adds a pain stimulus to the VR training to provide instant feedback on performance. This has been shown to enhance the quality of learning and the perceived level of stress.

Include an appropriate pain stimulus to the VR-Training in order to enhance the learning quality and level of perceived stress. Let the trainees choose from a level of light, medium, hard according

to their own preferences. As in marking cartridges training choosing for a no pain-stimulus training session is not an option. Same applies for role-players.

These guidelines apply only if the trainer is wearing a VR suit.

- The trainer wears a VR-suit in trainer mode to be able to give instant feedback during the scenario. The trainer can choose to be visible in the VR scenarios or remain invisible to trainees.
- The trainer wears a VR-suit in instruction mode and takes over an NPC to provide feedback from the point of view of a bystander or the suspect.